Gas Journal

VOL. 294. 110th YEAR. LONDON, APRIL 16, 1958 No. 4944 PRICE 1/6

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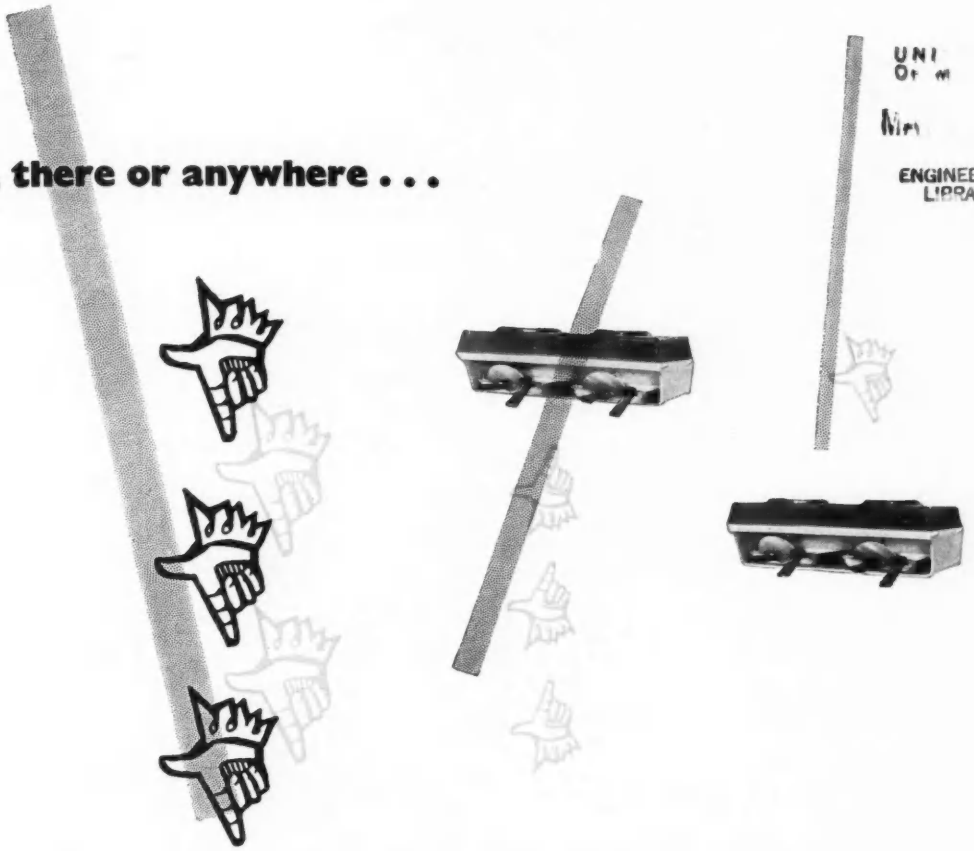

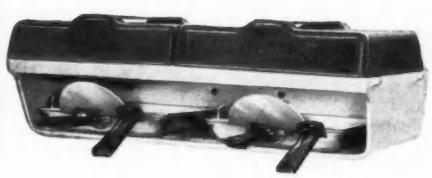

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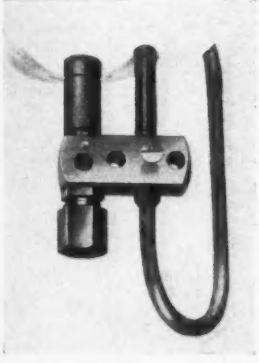

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Gas Journal

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110TH YEAR

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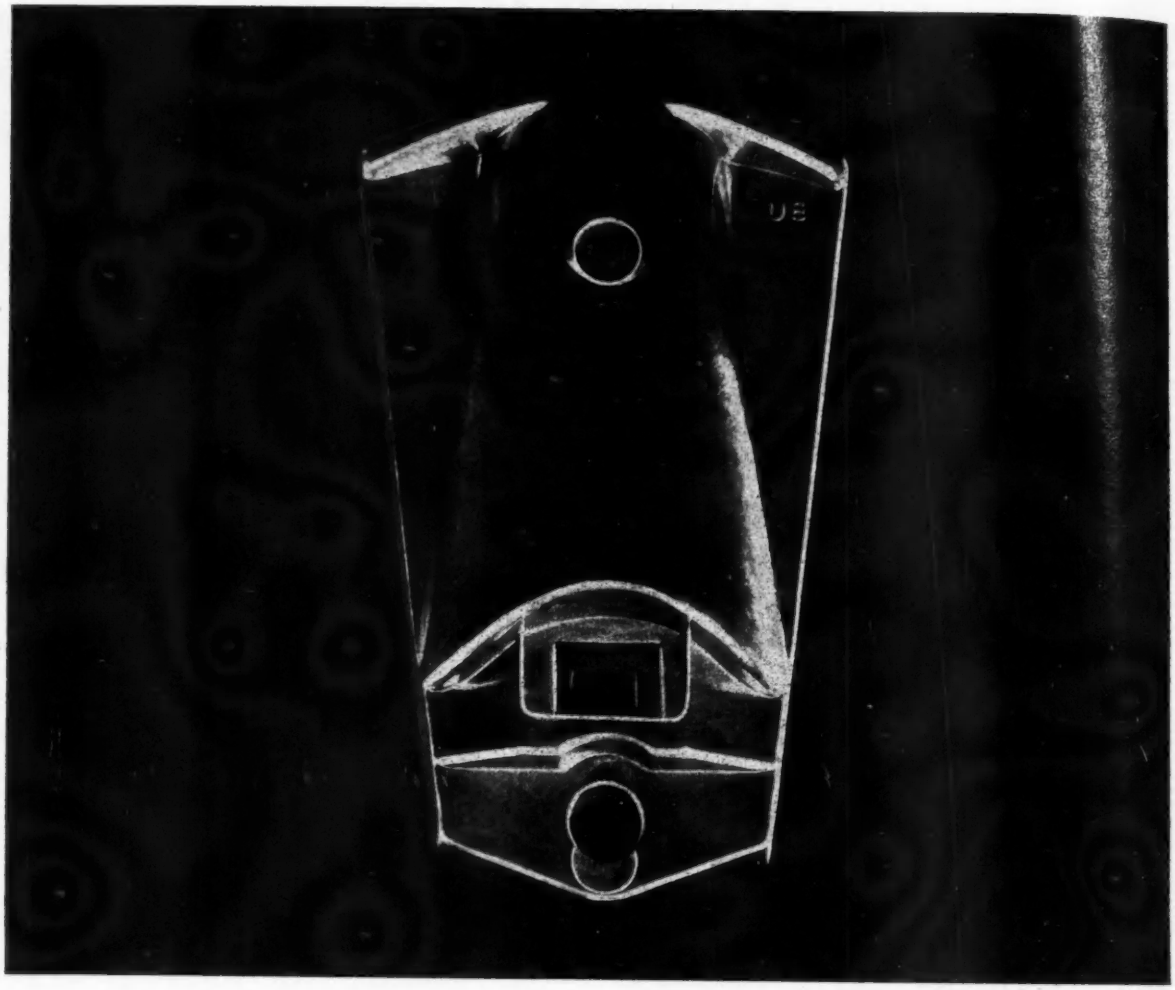

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Gas Journal

VOLUME 294. No. 4944. APRIL 16, 1958. 110th YEAR

Tugs on the Communication Cord

THE ability to impart information is rightly valued in engineering circles, the more so perhaps because as a profession engineers exhibit a certain clumsiness in communicating with their fellows. Unfortunately there is little evidence of any general realisation of this deficiency and it was for this reason that we noted with particular interest a paper simply entitled 'Communications,' written by Mr. H. B. Nuttall, Constructional Engineer for the Northern Gas Board's Tyneside Division, and presented to the Northern Juniors. It might seem odd that Mr. Nuttall should choose to give a paper on this subject when, he says, 'I have realised more and more my own shortcomings in this communication field,' but he does so not in order to pose as an expert but to arouse in the minds of his colleagues a critical interest in the way in which they impart information and instructions. That he appreciates the delicacy of his position is clear from his statement 'I find myself on trial delivering this paper.'

How does the author set about his task? By poking about in a dozen books and collecting a formidable quantity of more or less relevant anecdotes. Quotations are taken from diverse sources, from the sublime—Aristotle, Jonathan Swift and Sir Winston Churchill—to the ridiculous—the Civil Service and the music hall. Somewhere between the two perhaps is the 'GAS JOURNAL' from which quite lengthy sections have been quoted. Indeed, it seems to us that Mr. Nuttall's magpie instincts have led him to give his audience an excess of information, some of it akin to Ripley's 'Believe it or not.' We learn, for example, that a child of five has been found to use 35,000 running words a day, and that the normal human brain possesses 10-15 billion nerve cells. At the other extreme are accounts of curious conversations between such classic characters as First Navvy and Bert, and some of those incredible schoolboy howlers which go down so well with elderly gentlemen at the brandy and cigars stage.

However, it would be unfair to Mr. Nuttall to give the impression that his paper is a mere scrapbook. There are some amusing comments on the disadvantages resulting from providing processes and plant with long-winded titles. As he points out, workmen have the greatest fun and ingenuity in renaming them. He instances 'Candyfloss' at Blyth, 'Gloryhole' and 'Sputnik' at Elswick, 'Gut' and 'Gullet' at Redheugh, and 'Top Hat' at St. Anthony's. 'They mean more to the men than any names seriously considered by management.' And he mentions the 'Sherpas,' the name given by fellow workmen to those who climb a long, inclined conveyor; revivifiers are reduced to 'rivvies,' and a new hydraulic crane is 'the iron fairy.' Oddly, the author does not mention the effective naming of some of the great wartime operations. But we like this cryptic observation: 'The only time engineers attempt subtleties of meaning is when they are not in a position to state the true facts of a situation.'

Mr. Nuttall describes how facts can be distorted by the combination of the choice of words and the low (25%) effective listening rate. He stresses the value of engineering drawings which are kept up to date and of a sound filing system. He pleads for proper identification symbols on memoranda and for legible handwriting. He condemns pompous and unnecessarily wordy correspondence and has a little innocent fun at the expense of legal terminology. He concludes that the overburdened language we tend to use can be simplified to ease communication by our own careful discrimination and self examination. And he includes in his list of acknowledgments a word of thanks to his typist 'who had some difficulty to understand my script, and with whom arguments shall never cease about spelling, capital letters, hyphens and punctuation marks'; judging by his manuscript we fancy the lady won hands down!

The paper ends with disarming modesty: 'I marvel that this missive has been published.' We think it must be due to this modesty and the feeling of honest endeavour which characterises the paper that the discussion which followed its presentation last month was so good natured. Perhaps because members had expected some technical thesis on radar and telepathy,

contributions seemed to echo a mild surprise. While some members felt the author should have pursued his subject a little further, others seemed content to add to his store of funny stories. We thought Mr. W. R. Garrett (Newcastle) had a point when he suggested that short, sharp letters can be misconstrued and get people's backs up. He concluded that 'a few superfluous words are occasionally essential'—a comforting thought for the leader writer! We particularly enjoyed Mr. H. Buckley's assertion that the most effective men to give out instructions to workmen are men who speak the tongue of the workmen, *within the limits of decency!* (our italics).

Any man who ventures to speak on such a personal, albeit extremely important, subject as communications runs the risk of martyrdom. Yet only once was the author forced to assume the rôle of Aunt Sally—when Mr. R. Waugh (Sunderland) suggested that Mr. Nuttall was a recent convert to brevity as in his contribution to a discussion at a previous meeting he had called the speaker to task for this very quality. However, Mr. Nuttall got his own back—he pointed out that the notice of the meeting could have been made much shorter!

Zero Gas Costs

ALTHOUGH the gas industry is a chemical industry in the broadest meaning of that word, it has never been part of the recognised chemical industry in Great Britain. The by-products produced as a result of coal carbonisation could either be disposed of to specialist firms for working up, or if the undertaking was large enough a primary rectification of tar and benzole and the production of sulphate of ammonia could be undertaken. Such a state of affairs was perfectly satisfactory provided gas was a competitive fuel and able to hold its own with electricity.

Now gas manufacture may have to become an integral part of the chemical industry, with the production of valuable organic compounds, the proceeds from the sale of which might cover the entire costs of gas production. Such an idea was put forward in a paper by Mr. W. J. Cutler, of the Power-Gas Corporation, Ltd., in February, 1956, when he explained that by the thermal cracking of petroleum oils, enough ethylene could be made as a by-product to cover the cost of town gas production by this process.

In this issue, we are publishing a paper by Mr. Virgil Stark, of the North American Utility and Construction Corporation, on a similar process for the production of a low cost gas to meet peak load demands for natural gas. We have been fortunate enough to obtain a comment on this paper by Mr. A. C. Bureau, of Balfour Lecocq, Ltd., who is convinced that not only is the method of oil gas production suggested in the paper of considerable interest to gas engineers, but it involves a fundamentally revolutionary idea. For not only are the main objects of the process a great flexibility of production of a cheap gas of suitable calorific value, but a change of emphasis from the production of a gaseous fuel to the production of very valuable hydrocarbons for the chemical industry.

Mr. Bureau feels that in the past gas engineers have felt that their main objective was to produce gas as efficiently and as cheaply as possible. This has, perhaps, induced rather a narrow outlook which in many cases has shown itself in the refusal to consider certain techniques with respect to by-products on the grounds that a gasworks was not a chemical works. In the lifetime of the younger gas engineers of today the gas industry is likely completely to change and it is not impossible that it might die from obsolescence. The only long-term salvation of the industry will lie in its gradual transformation into a branch of the chemical industry specialising in the large-scale production of primary and fine chemicals, with particular emphasis on organic compounds derived from carbon containing materials such as coal or oil.

When any new processes for the production of cheap gas—which must still be a vital objective—are being considered, the possibility of the extension of the by-product market should be borne in mind. If sufficient foresight is exercised by the boards in the immediate future the continued existence of the industry could be assured by means of a gradual change of emphasis from the production of fuel as a main object to the production of basic and fine chemicals. In the course of such a gradual transformation the fuel market could also be held for a longer period by means of subsidisation from the chemicals increasingly produced.

A particular problem common to the United States and this country would be to determine the best method to be employed to realise the value of ethylene. At the moment in a limited number of cases it is produced and isolated in one works and passed over the wall by pipeline into the ultimate clients' works since transport by tanker is difficult and expensive. Such favourable conditions, however, are exceptional and, as Mr. Stark suggests, the logical method of disposal would be to convert the ethylene into some liquid product of potentially higher value, which can be more easily transported and stocked. This upgrading of primary products could be adopted with other materials produced in the gas industry with improved financial returns, and represents the trend of development which must be followed in the future. The paper deals with gas production in terms of natural gas replacement, but so far in this country natural gas is not available in any appreciable quantity. Nevertheless, with the addition of a reforming stage, the gas can be brought down to a C.V. of 400 to 500 B.Th.U. per cu.ft. with a specific gravity which will enable it to be mixed with or replace any normal town gas. Since the thermal efficiency of such a reforming stage is close to 100%, the arguments made by Mr. Stark with reference to gases of C.V. around 1,000 B.Th.U. per cu.ft. still substantially apply for gases of 400 to 500 B.Th.U. per cu.ft.

The paper shows a logical development of gas making combined with augmented by-product recovery, based on oil as the primary material, which is worthy of serious consideration, since the method could be applied immediately. Looking into the further prospects in the foreseeable future, however, with coal as a basis it should be possible in due course to develop an analogous scheme. It might be rewarding to re-examine the Fischer-Tropsch and other related methods for hydrogenation of coal with the different object of producing cheap residual gas at the same time as hydrocarbons of higher value than petrol for the production of which such systems were originally evolved.

Personal

MR. S. P. CHAMBERS, C.B., Imperial Chemical Industries, Ltd., has been appointed President by the Council of the Combustion Engineering Association for the year 1958/59. Vice-Presidents will be Sir John Charrington, Charrington, Gardner, Locket & Co. Ltd.; Mr. G. D. Elliott, John Thompson (Australia) Pty. Ltd.; Mr. H. C. Hawkins, The British Xylonite Co., Ltd.; Sir Percy, Sanders, C.B.E., Davey, Paxman & Co. Ltd.; Mr. R. H. E. Thomas, O.B.E., National Coal Board; and Sir Edward Thompson, John Thompson Ltd. Chairman of the Council will be Mr. L. N. Horne, Charrington, Gardner, Locket & Co. Ltd.; Honorary Treasurer, Mr. E. W. Barnes, Riley (IC) Products Ltd.

MR. JOHN SPAFFORD, Chairman and Managing Director of the Eagre Construction Co., Ltd., of Scunthorpe, has assumed the same position in the Isca Foundry Co., Ltd., of Newport, Monmouthshire, which the Eagre Company have taken over. COLONEL W. L. C. PHILLIPS, one of the recently retired Isca Directors, has been appointed Manager, with MR. J. THOMAS, formerly an Accountant with Eagre, as Secretary.

MR. R. J. MOFFAT, C.B.E., Director-General of Marketing to the National Coal Board, is to retire from the Board's service at the end of June. MR. F. WILKINSON, Manager of the Board's London and Southern Region Sales Office, is to succeed him.

Chancellor Halves Tax on Some Gas Appliances

YESTERDAY'S Budget proposals by the Chancellor of the Exchequer include a reduction in purchase tax on some domestic gas appliances from 60% to 30% as from today.

Electricity appliances would also benefit in the same way, while domestic oil appliances, hitherto tax free, would now carry 30%.

Sir Harold Smith, Chairman of the Gas Council, told the 'GAS JOURNAL' last night, 'The reduction of purchase tax from 60% to 30% on some gas appliances is disappointing, but all contributions are gratefully received.'

Gas appliances affected are: Space heaters, including fires, portables and radiators, water heaters, heated towel rails, linen cupboard heaters, motor-driven washing machines, drying cabinets, gas pistols and lighters, and refrigerators.

The Chancellor said there was little prospect of substituting a retail sales tax for purchase tax.

A petition delivered on March 7, organised by the 'GAS JOURNAL' and 'GAS SERVICE,' asked the Chancellor to remove hire purchase control and purchase tax from gas-fired domestic space heating appliances. There were many signatories, including 17 Members of Parliament.

LADY CAREW POLE has been appointed by the Secretary of State for Scotland and the Minister of Power to fill the remaining vacancy on the Committee on Co-operation between Area and Scottish Electricity and Gas Boards under the Chairmanship of Sir Cecil Weir. Lady Carew Pole is Chairman of the South Western Electricity Consultative Council and a part-time member of the South Western Electricity Board.

MR. JAMES DICKSON, Gas Manager at the Kirkintilloch works of the Scottish Gas Board for 41 years, has retired after more than 53 years in the industry. He was President of the North British Association of Gas Managers in 1936-37.

MR. W. J. WESTON has been appointed Birmingham Area Manager of Lancashire Dynamo Group Sales, Ltd.

Diary of Forthcoming Events

April 17.—INSTITUTE OF FUEL (EAST MIDLAND SECTION): Gas Showrooms, Nottingham. Annual General Meeting, followed by film. 6.15 p.m.

April 17.—MIDLAND JUNIORS: President's Day, including visit to Reading gasworks and luncheon at Great Western Hotel, Reading.

April 17.—EASTERN JUNIORS: Hitchin. 'Towards Preventive Maintenance,' by W. McM. Johnston.

April 18.—MANCHESTER AND DISTRICT SECTION, I.G.E.: Queen's Hotel, Manchester. Annual General Meeting at 2 p.m. preceded by luncheon at 1 p.m.

April 18. — LONDON AND SOUTHERN JUNIORS: Meyerstein Theatre, Westminster Hospital School of Medicine, Horseferry Road, S.W.1. General Meeting including paper by A. R. Bovington, 'The Glory Hill to High Wycombe, and Romford to Thameshaven Pipeline.' 6.30 p.m.

April 19.—WESTERN JUNIORS: Radiant House, Bristol. Annual General Meeting. 2.30 p.m.

April 21.—EASTERN G.C.C.: Ministry of Power (Gas Division), 26, Chapter Street, London, S.W.1. Meeting at 2 p.m.

April 23.—INSTITUTE OF FUEL: Great George Street, London, S.W.1. Meeting, including Presidential Address by H. McNeil. 6.30 p.m.

April 24.—NORTH OF ENGLAND SECTION, I.G.E.: Three Tuns Hotel, Durham. Joint Meeting with COKE OVEN MANAGERS' ASSOCIATION (NORTHERN SECTION). 7 p.m.

April 24.—INSTITUTE OF FUEL: Connaught Rooms, Great Queen Street, London, W.C.2. Annual Luncheon, 12.30 p.m.

April 24.—INCORPORATED PLANT ENGINEERS (SHEFFIELD AND DISTRICT): Grand Hotel, Sheffield. 'Factory Services and Supplies, with Particular Reference to Gas Requirements and Installation,' by F. Dickinson 7.30 p.m.

April 24.—NORTH THAMES G.C.C.: Caxton Hall, Westminster, S.W.1. Council Meeting.

April 24.—WALES AND MONMOUTHSHIRE JUNIORS: Aberystwyth. Annual General Meeting.

April 25.—MIDLAND SECTION, I.G.E.: Hotel Leofric, Coventry. Annual General Meeting at 2.30 p.m. preceded by luncheon at 12.15 p.m.

April 25.—INSTITUTION OF MECHANICAL ENGINEERS: General Meeting including James Clayton Lecture on 'Large Pipeline Projects,' by A. C. Hartley. 6 p.m.

April 29.—MIDLAND JUNIORS: Birmingham. Annual General Meeting followed by Paper, 'Sulphate-Reducing Bacteria and the Gas Industry,' by T. A. Dick.

April 30.—WALES G.C.C.: County Hall, Llandrindod Wells. Meeting at 11 a.m.

April 30. — LONDON AND SOUTHERN JUNIORS: Visit to Fondu works, West Thurrock, of the Lafarge Aluminous Cement Co. Ltd.

April 30.—NATIONAL BENZOLE AND ALLIED PRODUCTS ASSOCIATION: Grosvenor Hotel, Victoria, London, S.W.1. Annual General Meeting. 2.30 p.m.

Parkinson & Cowan Ltd. Annual Report

GAS METER AND APPLIANCE TRADE ABOVE EXPECTATIONS

IN his statement accompanying the accounts of Parkinson and Cowan Ltd., for the year ended December 31, 1957, the Chairman, Mr. Hugh P. Barker, says that during the year, the Company, did better in some directions than they had expected and less well in others than they had hoped. In the aggregate, they enjoyed a sound year of trading.

Group trading profit of £583,165 in 1957 was fractionally below the preceding year and earned a consolidated net profit of £159,306 compared with £173,739 in 1956. After allowing for Preference dividends, but before providing for annual debenture redemption and profits tax on dividend distributions, this figure represents earnings of 33% gross or 19% net on the Company's Ordinary stock. The sum of £26,865 has to be provided for the re-payment of debenture principal, but as this in turn creates an addition to reserve, it may be regarded as a part of the earnings on the equity.

Out of the net profit of £159,306 has been paid £19,571 in Preference dividends and payment of a dividend of 9% is recommended on the Ordinary stock absorbing £38,780. Profits Tax on dividend distribution will require £27,399 and of the remainder £40,000 has been applied to reserve and £26,865 to debenture redemption, leaving £6,691 to increase the carry forwards.

Vital and Permanent

Business in gas appliances and gas meters during the year was better than expected, the Chairman says. The manufacture of gas appliances and meters forms about a half of the Company's activity.

'Some people ask what future lies ahead for the gas industry and for the manufacturers interested in gas burning equipment,' continues Mr. Barker. 'I would like to assert in the most emphatic language that the gas industry has certainly a vital and permanent place in Great Britain as in many countries overseas. In recent years the progress of British gas as a fuel has been arrested in a squeeze between the rising price of coal, to which it is very sensitive, and the developing ubiquity of electricity and liquid fuel.

'But it is well known to those of us who work in the fuel industry that the future of a fuel is just like any other product. It depends on its price and its quality. In recent times, prompted by the Gas Council, the industry has started to exploit revolutionary techniques of gas-making, using cheaper grades of coal and oil as basic raw materials.

'These developments will succeed and, as the years go by, manufactured gas of superior physical properties and at very competitive prices will arrive on the domestic and industrial scene. I have no doubt that the gas industry will then resume its upward climb.'

Turning to Prospects for 1958, the Chairman says the year has started indifferently. They are fighting an atmosphere of recession by increased activity in technical development and commercial prospecting. Earnings are unlikely to rise during the year.

Works Closes

The bulk gas supply for the Bourne (Lincs.) area from Spalding has been turned on and the Bourne gasworks went out of production on March 17, after operating for over a century.

CLEAN AIR RESOLUTION

Grit and Dust Arresters

THE National Society for Clean Air has submitted the following resolution to the Treasury and the Ministry of Power:

'The Executive Council of the Society notes the inevitable need to use progressively greater quantities of small and fine coal, which, by increasing the potential emission of grit and dust, will make it more difficult to meet the requirements of Sections 5 to 9 (Grit and Dust from Furnaces) of the Clean Air Act, 1956.

'The Council therefore urges that all new or improved plant for the arrest of grit and dust should be eligible for loans under the Fuel Economy Plant Order, 1956, or for investment allowance under the Income Tax Acts.'

Lancashire Dynamo Group Profits Rise

AT a recent meeting of the Directors of Lancashire Dynamo Holdings Ltd., a final dividend of 7% on Ordinary stock, less tax at 8s. 6d. in the £, was recommended, making a total of 11%, less tax, for the year ended December 31, 1957.

Net profit of the Group for the year before taxation amounts to £746,565 (1956—£620,387), from which must be deducted taxation on these profits of £403,490 (1956—£342,160), and to which must be added taxation provisions no longer required £39,646 (1956—£23,068), leaving a balance available for appropriation of £381,721 (1956—£301,295) less £1,587 retained in subsidiary companies.

OFFICE MOVE WILL LEAD TO CLOSER CO-OPERATION

OWING to expanding business in power station, heating, ventilating and air conditioning instrumentation and control, the power plant division of Elliott Brothers (London) Ltd., has moved to larger offices adjacent to their associates James Gordon and Co., Ltd., at Dalston Gardens, Stanmore, Middlesex. The James Gordon Company themselves recently took over larger premises at this address.

The close co-operation already existing between the two Companies, both members of the Elliott-Automation Group, will thus be still further integrated in the planning and installation of power plant instrumentation and control systems.

The Elliott move covers sales projects and contracts office only, engineering and production remaining at the Lewisham works. The division remains under the management of Mr. Ralph Hussey, who has been with the Company for 35 years and has long associations with the industry.

The division's new telephone number is WORdsworth 0269.

16,000 Women will be Represented

HOMECRAFT interests of 16,000 women will be represented at Weston-super-Mare when the Women's Gas Federation hold their four-day conference, April 22-25. About 400 delegates will be there to talk about various aspects of the Federation's aim—to make life easier about the home.

'Housework with Ease,' for instance, is the title of one paper, to be presented by Miss Doris Robertson, the physical education specialist. Mr. L. W. Andrew, Director of one of the Gas Council's research stations, will deal with 'Appliance Research and You,' and Mrs. Shirley Williams travels down from the Treasury to put home economics into perspective with a contribution entitled 'The Nation's Housekeeping.'

Then there is the 'any questions' session conducted by Lionel Hale. Answering the questions will be Mr. C. H. Chester, Chairman of the South Western Gas Board; Miss Eirlys Roberts, Editor of *Which*, published by the Association for Consumer Research; Miss Rosemary McRobert, who has appeared regularly in the television panel 'Domestic Forum,' and Miss Phyllis Smale, the farmer and broadcaster.

Other speakers include Sir Harold Smith, Chairman of the Gas Council, and Dame Vera Laughton Mathews, the Council's Adviser on Women's Affairs.

During the conference—on April 24—the Federation will hold their annual meeting. In the chair will be the President, Miss K. M. Halpin.

BRITAIN'S ONLY INDIGENOUS NITROGEN SOURCE

The development of gas liquor as a fertilising service was first introduced by the North Eastern Gas Board last summer. Since then, large areas of grassland in the East and West Ridings of Yorkshire have been treated with gas liquor with entirely successful results. Pictured above, gas liquor is off-loaded from a tanker into a 500-gal. bowser on a Yorkshire farm. Among the advantages of the use of gas liquor is the fact that while it is basically the material from which sulphate of ammonia is produced, the manufacture of the latter requires large quantities of imported sulphate from dollar areas—gas liquor has only to be mixed with water to make it ready for application. It is in deed the only indigenous source of nitrogen available in this country. Humus is the basic indispensable factor in soil fertility and on large scale arable farms the return of organic matter to the soil to maintain the humic level is a great problem and it is essential that a source of nitrogen be added to the soil to speed humification of organic matter. Here a further big advan tage of gas liquor—that of not being easily leached from the soil—is of special value. The North Eastern Gas Board stress that the application of gas liquor by inexperienced operators is likely to give poor results; they have, therefore, appointed in their area two special contractors whom they consider competent to operate a complete fertilising service.

Gas in N. Ireland

LONDONDERRY COMPANY'S SALES AND PROFITS RISE

MOVING the adoption of the Directors' report and accounts at the recent annual meeting of the Londonderry Gaslight Company, the Chairman, Colonel Sir Basil McFarland, Bt., said increased gas sales at more than 370.5 mill. cu.ft., had produced an advance in revenue of £9,193. The quantity of coal carbonised, 19,350 tons, was the same as in 1956, but the cost had gone up by £6,889—an increase of 6s. 7d. per ton.

The Chairman said profit during the year, after providing for estimated taxation of £9,732, amounted to £23,138, compared with £15,803 in the previous year, an increase of £7,333, and, with the balance of £16,020 brought forward from 1956, made a total of £39,158.

Commenting that it had been a year of difficult trading for industry generally, the Chairman said they had every reason to be satisfied with the results achieved. Altogether the total income came to £251,315 (against £236,449).

Coke sales showed an improvement of £4,005 at £55,384, representing more than 6,000 tons. A coke grading plant had been in use since the beginning of the year, and coke was now available in all sizes.

The Chairman reminded the public that the Company were distributors of bottled gas, an ideal substitute where town gas was not available in rural areas beyond the range of the Company's mains.

The Chairman concluded by paying tribute to Mr. T. McDougall, Engineer and Manager; Mr. R. A. Rankin, Secretary; and the staff.

Works to Close

The Johnstone works of the Scottish Gas Board are to stop production soon. They will continue to be used for distribution.

New Plant for Belfast

Belfast Corporation has approved of the Gas Committee's decision to raise loans totalling £210,000 for new plant and equipment and the extension and improvement of supply to consumers.

Scottish Students

Special examination bays have been erected at the Canmore Street, Dunfermline, workshop of the Scottish Gas Board conforming to City and Guilds of London specifications so that 'mock' examinations can be taken by those candidates who will sit for City and Guilds examinations in May. The 19 students who are taking the 1958 examinations are receiving tuition here and at the Lauder Technical College, Dunfermline, from Mr. W. Affleck, Mr. F. German, and Mr. A. McCreary.

BETTER ASBESTOS PIPES ON THE WAY, SAYS FIRM'S CHIEF

THE Universal Asbestos Manufacturing Co., Ltd., is to install a mechanised asbestos cement pipe plant which will produce pipes of improved quality, and certain classes of pressure pipes. This news is given by Mr. Frank W. R. Douglas, Chairman of the U.A.M. Group, in his annual statement.

To meet the cost of new developments and to provide additional working capital, the Company intends to issue £260,000 convertible unsecured loan stock.

Mr. Douglas believes that, with the passing of the Thermal Insulation (Industrial Buildings) Act, 1957, greater quantities of the Company's insulating constructions will be required. U.A.M. Plastics Ltd., which began production of translucent sheeting in August, 1957, is already operating profitably, he states.

Initial production difficulties by Union Fibre Pipes (Great Britain) Ltd. have largely been overcome. The demand for pitch fibre pipes is good and their use has been approved by many local authorities.

Exports during the past year increased by some 25%, but returns were low due to intense competition in world markets.

In the year ending September 29, 1957, the Group's turnover was 'marginally higher' in spite of the general decline in building activity. The fall in trading profit to £201,358 from £340,135 in the preceding year was partly due to increased costs of raw materials, labour, and overheads.

Power-Gas Corpn. secure S. African Contract

Additions and Extensions to Chemical Plant

AFRICAN EXPLOSIVES AND CHEMICAL INDUSTRIES, LTD., are increasing the capacity of the No. 2 ammonia unit at their Modderfontein factory and have awarded certain contracts for extensions and additions to the unit to the Power-Gas Corporation Ltd., Stockton-on-Tees, England, and their associate, Ashmore, Benson, Pease & Co., Africa (Pty.), Ltd., of Johannesburg.

The contract for the gasification section covers modifications to the existing fixed bed dry base generators which are to be converted from cyclic semi-water gas operation to continuous oxygen/steam gasification. The fuel to be gasified is coke produced by the low temperature carbonisation of local non-caking coals.

These modifications together with extensions involving the installation of two new generators are to be carried out by Ashmore, Benson, Pease & Co., Africa (Pty.), Ltd., to the designs of the Power-Gas Corporation, Ltd.

The detailed engineering, supply, and erection of the extensions to the gas purification sections of the existing plant will be carried out by the Power-Gas Corporation, Ltd., in accordance with basic design data supplied by African Explosives and Chemical Industries, Ltd., and Imperial Chemical Industries, Ltd. (Billingham Division). These extensions, which are to be integrated with the existing plant, comprise equipment for CO conversion at low pressure, carbon dioxide removal and recovery using water wash, and high pressure carbon monoxide removal using copper liquor wash and final purification.

The increase in the ammonia synthesis capacity of the No. 2 unit will be met by a new synthesis section to produce the additional requirements of anhydrous liquid ammonia. This plant will be designed by I.C.I. (Billingham Division), and engineered and supplied by the Power-Gas Corporation, Ltd., with the exception of the synthesis converters which I.C.I. will themselves supply direct to A.E. & C.I.

During their recent tour of this country, gas engineers from Russia visited the works of the Power-Gas Corporation, Ltd., Stockton-on-Tees, for discussions on British Methods of gas-making. Members of the party are seen here when they met senior gas engineers and inspected gas plant under construction in the Power-Gas works.

Girl Wins

Before an audience of 500 in Leeds, recently, six teenagers—three boys and three girls—competed in the area final of the Gas Council's Youth in the Kitchen competition. The winner was 15-year-old Priscilla Winter, of Ripon, who will represent Yorkshire at the final in London.

Pictured above, the South Western Gas Board's Chairman, Mr. C. H. Chester, (extreme right) presents a 50 years' certificate to Mr. Albert Charles Willsmere, who also received a gas cooker and an armchair. Mr. Willsmere resides at Ross-on-Wye, where he has served under the Divisional Distribution Engineer on high pressure mains integration. Before nationalisation he was Engineer and Manager at the Ross-on-Wye works of the Severn Valley Gas Corporation, later becoming Unit Controller under the South Western Gas Board at Ross-on-Wye, Mitcheldean, and Newent; and later, Engineer and District Officer. The presentation marked not only 50 years' continuous service but also Mr. Willsmere's forthcoming retirement. Also in the photograph (extreme left) is Mr. James Carr, Deputy Chairman of the Board, and Mr. W. J. Baker, Board Member.

I.G.E. SOUTH WESTERN SECTION IN FROME

GUESTS at a recent meeting in Frome of the South Western Section of the I.G.E., presided over by Mr. T. L. Tallentire, Chairman, included Dr. J. Burns, President of the Institution, and Mr. H. M. Scott, Chairman of Frome Urban District Council.

Higher Grade Certificates in Gas Engineering (Manufacture) were presented to Mr. P. H. F. Hannah, of Torquay, and Mr. M. J. Pill, of Exeter.

After a talk by Mr. G. L. Spital, Managing Director, of J. W. Singer & Sons Ltd., members visited the Singer works.

Unexpected Visitor

Unexpected visitor to the Ayrshire regional finals of the Gas Council's Youth in the Kitchen competition, in Kilmarnock, was Major L. G. Milloy, Chairman of the Universal Cookery and Food Association.

RANSATLANTIC CABLE :: TRANSATLANTIC CABLE :: TRANSATLANTIC CABLE :

Security for converted cargo ship to take first gas load to U.K.

From Hilding H. Carlson

NEW YORK, *April 1.*

THE vessel being converted in America for transportation of liquefied natural gas to the North Thames Gas Board at Canvey Island, later this year, was built as a cargo ship rather than the tanker she is to become.

The 5,000-ton s.s. Normarti was owned by the Normarti Steamship Company before Constock Liquid Methane Corporation purchased her for conversion. Information of a technical nature is still most difficult to obtain; Constock is taking every precaution to protect its pioneering project. However, it is possible to give general data on the Normarti which, doubtless, will be renamed before she gets under way for the Thames Estuary. The vessel is 339 ft. long and has a 50-ft. beam. It has diesel engines and is said to have a speed of 11½ knots.

In some respects, the Normarti resembles a tanker. The cargo holds are forward and the engine is astern. All above-deck structure is astern.

The tanks for the liquefied gas will be welded aluminium, insulated by approximately 12 in. of laminated balsa wood. A steel jacket will enclose the insulation. In general, that scheme coincides with the construction of the storage tanks on Canvey Island. Dimensions for each of the vessel's five tanks will be in the order of 40 ft. long, 30 ft. wide and deep. Three of those tanks will be in the original forward-hold and the other two in the aft-hold. Each tank will carry approximately 400 tons of liquefied gas and will be at a pressure of 2 p.s.i.

Positioning of the tanks in the holds will permit inspection on all sides as a leak-detection measure. Instrumentation and alarms will supplement human inspections.

Present expectations by Constock are said to limit evaporation to 0.5% during the crossing. Actual evaporation will be metered after the tanker-to-be has been loaded and is under way. One possibility for the future— particularly in specially-designed gas tankers—is recycling equipment that will conserve all vaporised gas. The Normarti, of course, will be under constant expert observation for features to be considered in the larger tankers that would follow if the Constock method of gas transportation is successful—and Constock is fully confident it will be

Meanwhile, work on the s.s. Normarti continues

C

THE Blue Flame symbol of the American gas industry has been put to new public service use by Milwaukee Gas Light Company (Wisconsin), in the form of a 'weather flame.' Atop the undertaking's 24-storey headquarters building, a 21-ft. 'flame,' 9 ft. diameter, provides weather forecasts that are visible over a 25-mile radius.

The flame's weather messages are under the control of the gas dispatching department, which receives a continuing flow of weather data directly from the U.S. Weather Bureau over a teletypewriter circuit. When the flame is red, the forecast for the Milwaukee area is 'warmer,' a golden glow indicates 'colder,' and blue signals 'no temperature change.' If the flame flashes continuously, in any of the three colours, 'rain or snow' is to be expected.

The framework of the flame is welded stainless steel and a translucent quarter-inch plastic forms the skin. A built-in ventilating system has been provided for the 1,800 ft. of fluorescent tubing inside the flame. The structure was engineered to withstand winds of not less than 120 miles per hour.

The undertaking has publicised its weather service most thoroughly throughout the area of visibility. Tags printed in full colour are hung on gas appliances in Milwaukee Gas Light's own showrooms and those of appliance dealers. Wide circulation has been given to match books with interpretations of the weather signals.

under the strictest kind of technical security. Guards protect it in the Mobile, Alabama, shipyard from onshore scrutiny by unauthorised persons. Photographers are not permitted to approach it from the river side. Workers aboard are restricted to the specific sections of the vessel where they are assigned; the storage tanks are under construction at another point.

AMEN

At least one American undertaking has done something about the passenger automobiles it requires for its operations. Consolidated Edison Company of New York studied the worsening traffic problems here and determined that 'the present-day passenger car does not lend itself to most fleet operations because of its exaggerated styling, unnecessarily high horsepower, and big luggage compartment.' Consolidated Edison concluded 'it is just too much automobile!' (May we add, 'Amen'?)

With that, the undertaking's transportation department purchased 15 British-built Anglias, for testing. That selection was made after considering a number of other small European cars.

The head of Consolidated Edison's transportation told the 'GAS JOURNAL,' last month, that his new and very special little fleet is performing in good style but that there has not been sufficient experience to make an analysis of the exhaustive type that is usual in this undertaking.

NEGLIGENCE

ONCE again, words intended for the British gas industry have singular applicability to the American industry. Change the names and 'The Gas Industry and the Press' (leading editorial, 'GAS JOURNAL,' March 19)—just change the names and those words could have been directed throughout the 48 States.

Press relations for some undertakings here are far from good—due to their own wilful and determined negligence. There are prime examples of undertakings that *were* in virtual disrepute with the Press and, consequently, with the public but changed their views—as policies adopted by top-management. With well-designed programmes and procedures, they stand now in glowing contrast to their former selves.

The die-hards still find it difficult to face facts frankly, when there is 'bad news.' Explosions and CO poisoning cause some executives to practically close the doors, windows and telephone boards—even before they find out *how* the incidents occurred. They choke at the very thought of telling the Press, 'Yes, there was an explosion. Our engineers have determined that the customer turned on the oven gas—but did not light it.' Instead they order a hear-nothing, see-nothing, tell-nothing attitude by all hands. When newspapers, radio and television report, 'Oven blows up as widow cooks dinner,' those same executives are in urgent need of adrenalin. If we may second-guess the Editor, we would delete the word, 'nearly' in his view that 'attempts to hush up bad news are nearly always doomed to failure.'

Public relations programmes in the American industry and in individual undertakings are having a steady and gratifying expansion. During the past five years, adoptions of a more enlightened viewpoint have produced results that accumulate incalculable advantages. Those programmes go far beyond basic publicity and news—those are just segments of the programmes. Customers, prospects, employees and their families, appliance manufacturers and dealers, manufacturers of operating equipment, the government agencies, legislators, architects, builders, installing contractors, competitive electric undertakings, neighbouring gas undertakings, schools, universities, shareholders, the financial world, and 'the community'—each is a separate 'public.' The more-advanced programmes here include specialised handling of each—with press releases, educational booklets, films, demonstrations, personal appearances and special-purpose publications.

Through all the work in the enlightened programmes of the undertakings here, the very points which the Editor referred to as 'admittedly elementary' stand as the bedrock.

INVESTMENT

AS part of its continuing campaign against further encroachments on the American gas industry by government-ownership schemes, the public information department of American Gas Association has prepared a fast-paced, cartoon-illustrated booklet, 'What Everyone Should Know About the Advantages of Investor-owned Gas Companies.' Mr. James M. Beall, director of public information, says it is intended for distribution to employees, investors, customers and special-interest groups. 'In contrasting the pitfalls of government ownership with the merits of competitive enterprise,' Mr. Beall said, 'we have avoided becoming profound in this piece.'

TARIFFS

HAVE you ever wondered about the tariffs of American undertakings?

Consolidated Edison Company of New York, Inc., has just issued a new tariff card for its Gas Service Classification No. 1, which applies to residences. Here are the two-months' tariffs, per meter, for 1,000 B.Th.U. gas:

First 600 cu.ft. or less—£1 1s. 5d.

Next 1,800 cu.ft.—1s. 9¼d. per 100 cu.ft.

Next 3,600 cu.ft.—1s. 5d. per 100 cu.ft.

Next 4,800 cu.ft.—1s. 1½d. per 100 cu.ft.

All over 10,800 cu.ft.—11d. per 100 cu.ft.

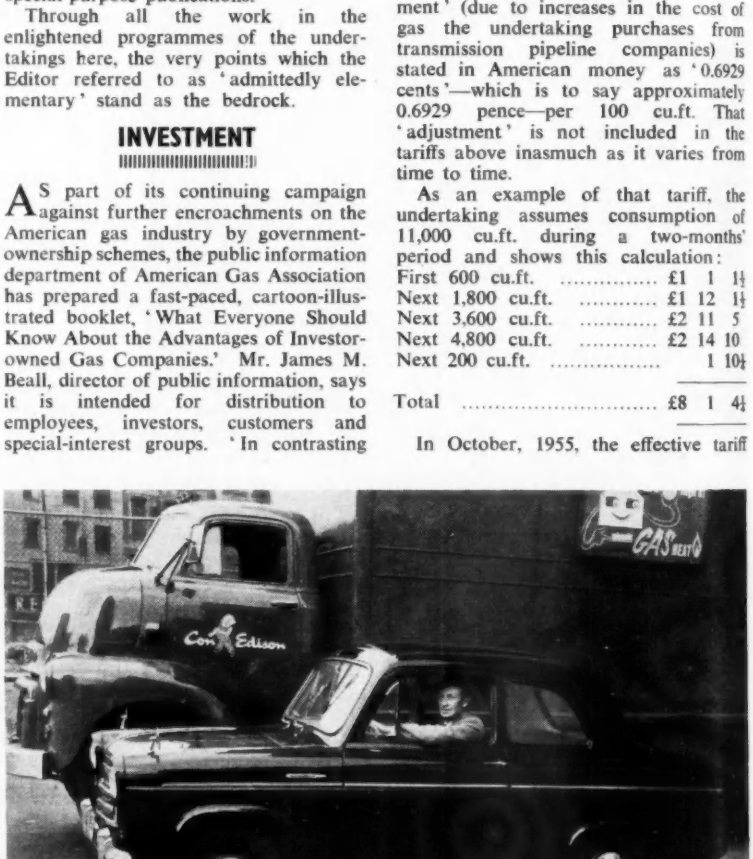
The minimum two-months' charge, exclusive of 'purchased gas adjustment,' is £1 1s. 5d. Payment is due within ten days after bills are received by the customers.

Currently, the 'purchased gas adjustment' (due to increases in the cost of gas the undertaking purchases from transmission pipeline companies) is stated in American money as '0.6929 cents'—which is to say approximately 0.6929 pence—per 100 cu.ft. That 'adjustment' is not included in the tariffs above inasmuch as it varies from time to time.

As an example of that tariff, the undertaking assumes consumption of 11,000 cu.ft. during a two-months' period and shows this calculation:

First 600 cu.ft.	£1	1	1½
Next 1,800 cu.ft.	£1	12	1½
Next 3,600 cu.ft.	£2	11	5
Next 4,800 cu.ft.	£2	14	10
Next 200 cu.ft.		1	10½
Total	£8	1	4½

In October, 1955, the effective tariff



A fleet of 15 British-built Anglias is under test by Consolidated Edison Company of New York, Inc., to overcome the traffic and parking disadvantages of American cars which, the superintendent of transportation said, are 'just too much automobile.' Here, one of the new passenger vehicles has been posed alongside one of the undertaking's big vans—complete with poster extolling 'Gas Heat.'

shows that the billing for 11,000 cu.ft. would have been £8 0s. 8½d. Increases since that time have been in the smaller volumes.

Con. Ed is 'combination undertaking.' That is, it sells both gas and electric services. So, a brief look at the tariff for residential electric service will provide a comparison within that undertaking's area.

The two-months' electric tariffs are:

First 20 kW hours or less ...	11s. 4¾d.
Next 100 kW hours	3¾d.
Next 100 kW hours	3d.
Next 100 kW hours	2½d.
All over 320 kW hours	1½d.

An assumed use of 350 kW hours during a two-months' period would be billed at £4 14s. 3½d. That would have been the billing in October, 1955. 'Fuel adjustment' is applied to electric billings, too. Currently, that is stated as '0.1692 cents.'

WELCOME

AMERICAN Gas Association announces two new members from the British gas industry: Mr. Frank W. Allum, North Eastern Gas Board, Leeds, and Mr. Herbert R. Hazeldine, Eastern Gas Board, Westminster.

SCHIZOPHRENIC

'SALE . . . Old Baltimore street lamps. 42-in. over-all, electrified and mounted on sturdy wooden posts, ready to set up on your property. Approximately 8 ft. high, including post, when set up. Usually [£27 17s. 11½d.], now [£20 14s. 3½d.]. Housewares, fifth floor.'

So reads an advertisement, with illustration, by a leading New York department store. And so will go some of our old street lights to make 'ye olde quainte touche' on the lawns of Suburbia in front of split-level residences (that, often, match the owners' personalities).

SERVICE

LAST month, Transatlantic Cable went to considerable length in criticising the American undertakings that had 'lost' their gas distribution systems during a protracted period of cold weather. That was due to their inabilities to supply adequate gas to their customers to whom they have made firm commitments, you may recall.

Now, as an example of avoiding such a situation, we point with pride to one of the undertakings that maintained service and supply.

Southern Indiana Gas and Electric Company, a relative small undertaking, notes in its annual report to shareholders that December 11 was a new maximum day, requiring a sendout of 65.96 mill. cu.ft. (of 1,000 B.Th.U. gas). It met that test without curtailment of service to customers, by withdrawing 28.88 mill. cu.ft. from its own underground storage field and taking the rest of the gas from the pipeline with which it is connected. Thereby, the heavy penalty for more-than-contract gas from the pipeline was avoided.

This undertaking reports that at year's end, the heating-customer saturation in its service areas was 71.8%. Something about the 'health' of the Company can be seen in its 1957 earnings of 16s. 10¼d. per share, compared with 13s. 7½d. in 1956.

ELECTROLUX

THE gas refrigerator business is becoming more spirited in the U.S. After Servel's quiet departure from the field, there was some concern here as to the gas industry's future in home refrigeration. Finally, Whirlpool Corporation picked up the fallen cause, as noted in February's Transatlantic Cable. Certainly, it is agreed that it went into capable hands.

Now, the Norge division of Borg-Warner Corporation, another large appliance manufacturer, has announced that it will produce a gas refrigerator. Production will be under way in early-1959. Field tests will be conducted this summer.

The basic refrigerating unit will be the Electrolux absorption unit, presumably similar to the one produced in Great Britain. Norge will house it in the same cabinet that is used for its presently-produced electric refrigerator. The Company reports that it has developed an automatic ice-maker that will be incorporated in the refrigerator.

Many observers of the American gas appliance industry have contended for a number of years that 'there's nothing wrong with the gas refrigerator that wouldn't be cured by a strong competitive manufacturer.' There will be competition as Whirlpool and Norge put their respective research, manufacturing, promotion, advertising, sales and distributive powers to work. The inevitable result will be that more prospective purchasers will be aware that there is such a thing as a gas refrigerator. That competition seems certain to become emphatic—and that, in the gas industry's best interests, is as it should be.

SHUT-DOWN

AFTER 40 years in which the strongest by-product business of all American gas undertakings was developed, Portland Gas & Coke Company (Oregon) has shut down its oil-gas plant, due to heavy operating losses that followed conversion of the undertaking's distribution system to natural gas—largely from Canada.

Though no U.S. undertaking has maintained operation of an oil-gas plant after obtaining adequate supplies of natural gas, the Portland undertaking made an

PUBLIC RELATIONS ACHIEVEMENT

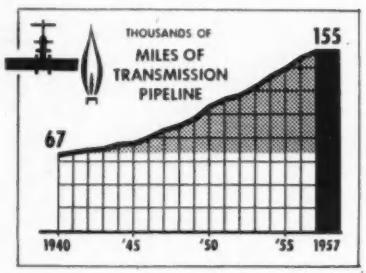
ABOUT eight years ago, Southern California Gas Company, Los Angeles, determined to overcome the often incomplete and erroneous reports of emergencies involving gas. Originally, a training programme was aimed at fire departments through the service area. That programme was presented more than 100 times. Then, booklets and motion pictures relating to emergency situations were prepared. Gradually, with time-to-time additions, the programme has developed to include 'live gas' demonstrations and a number of new printed pieces. The undertaking now finds a vastly-improved relationship among the police and fire departments of its area. And, 'instances of incorrect and sensational treatment of minor incidents . . . do not occur today.' In the educational segment of this undertaking's programme, it notes that 'the proportion of students answering that natural gas is poisonous dropped from about 75% to about 2%.' The school administrators regard the educational value of the California undertaking's programme so highly that they invite annual presentation.

The objective and the manner in which that objective has been met earned first-place for Southern California Gas Company in the American Gas Association's public relations achievement awards last year. Mr. F. Marion Banks, president and general manager of SoCal (centre), is shown here receiving the trophy for his company from Mr. Clare Zachry, immediate-past-president of AGA. Mr. Frank C. Sullivan, the company's public relations director (right), has the smaller replica that was awarded to the excutive responsible for the winning programme.

intensive effort to keep its plant in operation on a year-round basis by transforming it to primarily a petrochemical plant. During the past year, research was rushed to change the plant so that oil-gas would become a minor product. Other products that were produced by the Portland company included carbon, electrode pitch and benzole.

PIPELINE

THE gas transmission pipeline network of the U.S. expanded by 5,000 miles during 1957, American Gas Association



reported last month. From 67,000 miles in 1940, yearly additions to the network have raised the total to 155,000 miles—a 17-year expansion of 131%.

CONSUMPTION

ELECTRIC undertakings' power plants, according to a report by Federal Power Commission, aggregated these fuel consumptions last year: Gas, 1,338,078.5 mill. cu.ft.; 8% more than in 1956. Coal, 160.76 mill. tons; 1.6% above the 1956 total. Fuel oil, 79.56 mill. bbls.; 9.4% over 1956.

SIMPLIFICATION

EXPERIMENTAL plastic-cased gas meters have been put in service by Southern Counties Gas Company, Los Angeles. The meters were installed as a co-operative programme for Rockwell Manufacturing Company, to determine the outdoor service and durability in California weather. The 200 experimental meters have the same mechanism that is used in metal-cased meters. The expectations being tested are, primarily, the elimination of painting and the simplification of cleaning with just warm water.

Metal requirements by American undertakings and pipeline companies, through 1960, have been estimated by the American Gas Association.

	1958	1959	1960
Steel pipe (1,000 tons)	2,443	2,471	2,452
16-in. and larger ...	1,492	1,302	1,146
6¾-in. to less than 16-in.	520	620	665
Less than 6¾-in. ...	431	549	641
Other steel	24	28	28
Cast iron (thousands of tons)	162	195	218
Copper (tons)	2,534	3,321	2,619
Aluminium (tons) ...	341	431	504

Simplified installation procedure characterises a new line of gas-fired duct furnaces pictured above, recently announced in the U.S., and offered in eight sizes with outputs ranging from 50,000 to 230,000 B.Th.U. Compactness makes the units adaptable to low-ceiling applications in stores and other commercial establishments. They may be used with new or existing duct systems and are designed for single or multiple unit installations. The blower assembly for the heated air is available as open or encased equipment, to provide further flexibility in arranging the duct systems.

AMERICAN REFERENCE BOOK EXTENSIVELY REVISED

ONE of the most highly respected engineering reference works, 'Heating, Ventilating, Air Conditioning Guide,' has been thoroughly reviewed and revised extensively in the publication of its 36th edition.

The technical data comprise 1,272 pages, presented in the familiar seven-section format: I—Fundamentals, II—Human Reactions, III—Heating and Cooling Loads, IV—Combustion and Consumption of Fuels, V—Systems and Equipment, VI—Special Systems, and VII—Instruments and Codes.

The 'Guide' is an annual publishing project of The American Society of Heating and Air-Conditioning Engineers. The 11-man committee responsible for co-ordinating the project is made up of specialists from the profession in America and Canada. Their exhaustive annual evaluations consider material that has been compiled by the Society's research laboratory and individual members, other engineering societies and their members, industrial and institutional laboratories, and trade associations.

Air Duct

The new edition includes revisions and additions in 14 of the 53 chapters.

A description and a design method for high-velocity air duct systems has been added in this edition. And there is a simplified presentation of industrial drying principles, calculations and system design.

Data has been extended on heavy fuel oils and their use, preheated, in automatic fuel burning equipment. The section on the electric heat pump has been enlarged from research and operating experiences that have been evaluated since the previous edition was published.

A general revision has been made throughout the data and information on radiators, convectors, baseboard and finned-tube units. This includes the addition of new data on the ratings and performance of those units.

Enlargement

Recent developments in performance and testing of air cleaners have necessitated an enlargement of this section and the list of allowable concentrations of air contaminants has been extended.

The well-established 'ASHAE Psychrometric Chart,' measuring 24 in. × 32 in., is included in a pocket on the back cover of the volume.

In addition to the technical data that are presented with strict impartiality as to commercial interest, the 'Guide' includes a 503-page section with data on specific equipment relating to most subjects considered in the technical section. Those pages contain data and descriptive information on equipment application and performance. A separate and extensive index directs readers to considerations of interest.

This volume continues its service of maintaining reliable information on current practice in a manner that is beneficial to engineers, installing contractors, educators, and students.

Presented as a part of the 'Builder's Report' at the Production Conference of the Operating Section, American Gas Association, Bal Harbour, Florida, May 20-22, 1957

Typical Application of a Process for the Production of a Low-Cost Gas as a Substitute for Natural Gas

By VIRGIL STARK,
NORTH AMERICAN UTILITY & CONSTRUCTION CORP., NEW YORK, N.Y.

TO cover peak load requirements, utility companies distributing natural gas are faced with the problem of manufacturing gas from other fuels. Such gas must be a good substitute for natural gas in order to be suitable for mixing in large proportions. It must also be economical and readily available at all times. This study outlines a process for the production of manufactured gas at very low cost, sometimes even lower than that of natural gas. The volume of manufactured gas available for sendout is very flexible and can be varied substantially. This patented process is described in several publications.[1, 2] The present study covers the typical application of an improved simplified design.

Oil gas may be mixed with natural gas in a maximum proportion of approximately 50%.[3, 4, 5] However, if all year round, approximately 5% hydrogen is added to the natural gas, the proportion of oil gas may be increased to approximately 62%[3]. Complete interchangeability may be achieved by hydrogenation of the oil gas when adding 50 cu.ft. to 70 cu.ft. of hydrogen per gal. to make oil.[6]

It is noted that the content of propylene (C_3H_6) and higher unsaturates in the oil gas increased in relatively greater proportion than its corresponding heat value. The present study is based on production of an oil gas of 1,250 B.Th.U. per cu.ft., rather than on the more customary calorific value of 1,000 B.Th.U. per cu.ft. In such case, the content of higher hydrocarbons and C_3 is substantially greater, approximately double that for an oil gas of 1,000 B.Th.U. per cu. ft. A special extraction process separates part of the C_3 and most of the C_4 to C_8 components in the oil gas. The oil gas after such extraction has a specific gravity of only .69 instead of approximately .86 for conventional oil gas, thus making the gas after extraction more readily interchangeable with natural gas.

Cover Heat

Depending on market conditions, the value of the separated by-products may be as high as five times the value of the heavy fuel oil used in their production. This results in very low cost for the gas after extraction, possibly lower for equivalent heat value than the heavy fuel oil or the natural gas. During low sendout periods, the gas after extraction can be used to cover heat and power requirements of the plant. As much as two-thirds of the gas produced may be used for this purpose. During peak load periods, these requirements may be covered by liquid fuels, thus making more gas after extraction available. The oil gas and extraction plant operates at full rated capacity all year round, and the quantity of gas after extraction may be varied to obtain during peak load periods as much as 2.5 times the volume required at lowest sendout periods. The maximum peak load could be covered by a mixture of natural gas, gas after extraction and oil gas, thus obtaining a volume of up to seven times the one required for the lowest day load. This will eliminate the necessity of operating an oil gas plant for only a few days per year, an operation both costly and impractical. It frequently happens that the emergency peak period is already over by the time production can start after prior preparation to this effect.

This process provides not only a substitute gas at very low cost, but a gas that is perfectly purified and available under pressure. As the cost of the gas will be less than one half of the Bunker C oil of equivalent calorific value, it will make it possible to supply fuel for power plants at greatly reduced cost. This study covers a typical application of the process based on New England market conditions.

Both the analysis and the heat value of the oil gas depend on the operating conditions, and in particular on the degree of cracking. Partial pressure, residence time and type of fuel are also influencing factors, but of smaller significance.[7, 8, 10] By varying these conditions, and in particular the cracking temperature, an oil gas of required calorific value and with predetermined content of hydrocarbons may be produced in a conventional oil gas generator. For instance, at a cracking temperature of 1,350°F., the calorific value of the oil gas may be as high at 1,600 B.Th.U. per cu.ft., and the content of unsaturates of C_3 and higher 22.8% and of ethylene 26.7%. If the severity of cracking is increased to 1,700°F., for instance, the calorific value would be only around 700 B.Th.U. per cu.ft., the content of C_3 and higher hydrocarbons, only .4%, and of C_2H_4 only 4.2%.[7]

Approximate Analysis

By operating a conventional oil gas generator at preselected conditions and specifically by using a lower cracking temperature, a gas of 1,250 B.Th.U. per cu.ft. may be produced. The following approximate analysis confirmed by available operating data from various plants, may thus be obtained:

	%
CH_4	33.0
C_2	24.0
C_3	6.6
C_4	3.8
C_5	1.2
C_6	2.5
C_7	.85
C_8	.05
H_2	16.00
CO	2.5
O_2	.3
CO_2	2.5
N_2	6.7
	100.0
Calorific value	1,250 B.Th.U. per cu.ft.
Specific gravity	.86

The following table, based on operating data of several plants, indicates the percentage of C_3 and higher for oil gas of various heat values, based on unscrubbed oil gas.

A process combining compression, refrigeration, absorption, distillation, recompression and fractionation would be applied in a plant specially designed for it. The gas after extraction is thoroughly purified not only from organic sulphur, but also from condensibles which otherwise may cause disturbances in the distribution system. In general, the calorific value of natural gas is approximately 1,050 B.Th.U. per cu.ft., which is more than the contractual one of 1,000 B.Th.U. per cu.ft. Therefore, it is preferable that the calorific value of the gas after extraction be under 1,000 B.Th.U. per cu.ft., thus compensating for foregoing excess over contractual heat value. This study considers production of a gas after extraction of

TABLE 1

Typical Case	*I*	*II*	*III*	*IV*	*V*	*Selected for this study*
Calorific Value B.Th.U. per cu. ft. . .	1,240	1,165	1,248	1,310	1,210	1,250
C_3	6·66	5·4	6·2	9·9	7·0	6·6
C_4	3·95	1·9	4·2	3·3	2·9	3·8
C_5	1·4	0·4	1·28	0·4	0·6	1·2
C_6–C_8	2·9	4·6	4·4	3·5	6·2	3·4
Total	14·91%	12·3%	16·08%	17·1%	16·7%	15.0%

975 B.Th.U. per cu.ft. By mixing such gas with natural gas (1,050 B.Th.U. per cu.ft.), in a proportion of as much as 70% a final gas of minimum 1,000 B.Th.U. per cu.ft. can be obtained. If desired, however, the heat value of the gas after extraction can be adjusted either by changing the operating conditions or by enriching it.

The gas after extraction (E), as in the foregoing, will be of the following approximate analysis (in percentage by volume):

	%
CH_4	38.00
C_2	27.50
C_3	2.60
C_4	0.40
H_2	18.40
CO	2.80
O_2	0.30
CO_2	2.80
N_2	7.20
	100.00

Calorific value approx. ... 975 B.Th.U. per cu.ft.
Specific gravity (air — 1) ..... .69.

This study of by-products extracted is based on the extraction and recovery of approximately 65% of C_3 and 95% of C_4 to C_8. If ethylene is extracted, the C_3 alternate would be higher (approximately 95%). Each 1,000 cu.ft. of oil gas (1,250 B.Th.U. per cu.ft.) will correspond to 873.2 cu.ft. of gas after extraction (E) (975 B.Th.U. per cu.ft.). Therefore, of the 1.25 mill. B.Th.U. per 1,000 cu.ft. of oil gas, after the extraction process 854,000 B.Th.U. are contained in gas (E) and 396,000 B.Th.U. in the separated by-products.

The equipment for separation, extraction and fractionation can be so designed and operated as to obtain a variety of final by-products of desired analysis and purity to meet the requirements of the prevailing market. Even though the total quantity of extracted products is the same for various solutions, the quantities per cut will vary. The following typical application refers to a plant with a capacity of 6 mill. cu.ft. per day. To be economical, the minimum capacity of such a plant should be 1 mill. cu.ft. per day.

The following typical solutions refer to different groupings of by-products (P_1, P_2, P_3). We have selected the intermediate solution, P_2, as a basis for this study. Corresponding data would be used to establish the credits for by-products under the other solutions. All by-products covered by this study can be stored and shipped in conventional tanks. The table below indicates quantities of recovered by-products in gal. per 1,000 cu.ft. oil gas. The cuts are mixtures, denoted by the hydrocarbons present in greatest percentage. We indicate below prices per gal. for solution P_2 in carload lots based on current conditions in the New England region. However, in order to provide for conservative planning, credits for by-products are based on lower than currently prevailing prices. Credits for by-products for other solutions must be calculated based on prevailing local market conditions.

Table 2.

	Gal./1,000 cu.ft.	*1,000 gal./year*
Solution P_1		
Propylene (C_3)	1.14	2,500
Butylene-Butadiene (C_4)	1.10	2,420
Cyclopentadiene-Pentene (C_5) ...	0.30	650
Benzene (C_6)	0.70	1,530
Toluene (C_7)	0.26	570
Total P_1	3.50	7,670

Table 3.

	Gal./1,000 cu.ft.	*1,000 gal./year*
Solution P_2		
Propylene (C_3)	1.14	2,500
Butylene-Butadiene-Pentene (C_4C_5)	1.40	3,070
Benzene (C_6)	0.70	1,530
Toluene (C_7)	0.26	570
Total P_2	3.50	7,670
Solution P_3		
LP-gas (C_3C_4)	2.15	4,700
Light oil (C_5)	0.25	550
Raw benzole (C_6 mixed with $C_5C_7C_8$)	1.10	2,420
Total P_3	3.50	7,670

The estimated credits for by-products for the intermediate solution P_2, f.o.b. production plant are shown below.

Cut	*gal./1,000 cu.ft.*	*cents/gal.*	*cents/1,000 cu.ft. oil gas*
C_3	1.14	14	15.96
C_4C_5	1.4	11	15.40
C_6	0.7	33	23.10
C_7	0.26	29	7.55
Total			62.01

Since the extent of the economical advantages of the process depend greatly on the market for by-products, the following remarks are made regarding such markets for the above indicated cuts.

The propylene cut (C_3) consists of approximately 91% propylene, 7% propane, and 2% C_4. In 1955, U.S. propylene consumption was 317 mill. gal.[12] Most of it (204 mill. gal.) was used in the production of isopropylalcohol, base material for esters (30%), and as a gasolene additive (11%).[13] Furthermore, it is used to obtain glycerine (13 mill. gal.), acrolein, detergents (alkane, etc.) 13 mill. gal. Phenol made by the cumene process uses propylene and benzene. A new process now being developed to produce polypropylene, a similar product to polyethylene, may greatly increase the demand for propylene. It may be of interest in certain cases to locally polymerise the propylene into dodecene (used for detergents). By doing this, a higher value by-product may be obtained, which is in great demand and which can be stored and shipped in low pressure tanks.

L.P. gas may either be obtained in the form of C_3C_4 cut as in solution P_3, or as C_3 only. In 1955, 458 mill. gal. of L.P. gas were shipped to the East, mostly from the South.[21] The consumption in New England alone was 128 mill. gal. per year. Butylene-butadiene-butane (C_4) represents approximately 75% of the C_4C_5 mixture, considered under solution P_2. This can be used as an additive for higher octane gasolene. If C_4 is separated as in solution P_1, it could be sold for the production of butadiene, which is generally produced from butylene and butane. The market value of butadiene (U.S. consumption 800,000 tons per year) is 80 cents a gal. The separated C_5, solution P_1, could be used in the manufacture of dicyclopentadiene (marketable at 60 cents a gal. for 75%

purity) which, in turn, is used for insecticides (chlordane). Raw benzole, as in solution P_2, is a mixture of C_6 with $C_7C_8C_9$, which is sold to others for further processing. Benzene (C_6) and toluene (C_7) of desired purity could be obtained, if as in solutions P_1 and P_2, the fractionation is done at the extraction plant.

Benzene (C_6) consumption in the U.S. amounted to 263 mill. gal. in 1955. It was used in the production of styrene (35%) phenol (21%), detergents (10%), aniline (5%), chlorobenzene (5%), DDT (4%), others (20%). Toluene (C_7) sales accounted for 138 mill. gal. in U.S. in 1955.[12] It was used for manufacture of aviation gasolene (46%), solvents and coatings (22%), explosives (13%), chemical syntheses (13%) and miscellaneous (6%).[13] Ethylene (C_2).—The extraction plant is so designed that, at a later stage, equipment can be added to extract the ethylene still remaining in the gas after the first extraction step. As such gas is already compressed at 60 lb. per sq. in. gauge and cooled, only additional compression and refrigeration is required. The extraction of ethylene (approximately 22% of the gas after extraction) represents approximately 14 lb. per 1,000 cu.ft. or for a 6 mill. cu.ft. per day plant approximately 30 mill. lb. per year. The extraction of C_3 (95% instead of 65%). Due to such extraction, approximately 450,000 B.Th.U. per 1,000 cu.ft. of oil gas will have to be deducted from the available heat value for the 6 mill. cu.ft. per day value of C_2 and C_3 and for the additional power and heat requirements of the plant.

Gas after Extraction

If gas is used to cover all requirements for heat and power, in the case of C_2 extraction the plant can produce only by-products and no gas whatever will remain available for sendout. This is of interest for chemical manufacturers. If liquid fuels are used to cover all the heat requirements of the plant and gas for the power requirements, there will remain in gas after extraction 0.34 mill. B.Th.U. per 1,000 cu.ft. of oil gas, *i.e.*, 3,040 mill. B.Th.U. for a 6 mill. cu.ft. per day oil gas plant. This gas has a calorific value of about 740 B.Th.U. per cu.ft. and 0.57 specific gravity. With credits for the by-products (C_3-C_7) as solution P_2 and gas available credited 20 cents per mill. B.Th.U., the cost of ethylene produced is approximately 1.5 cents per lb. As the market value of ethylene is approximately 5 cents per lb. such additional plant will make possible an extra profit of approximately $1 mill. per year, which would amortise it in less than two years. However, since ethylene cannot be transported in conventional tanks, such a plant is only feasible with further chemical manufacturing, such as, production of ethylene oxide, ethylene glycol, ethylene alcohol, polyethylene, etc.; or combination with other by-products such as benzene, to obtain styrene, etc. These developments do not form part of this study.

Other advantages of the extraction process are:

1. As substitute for natural gas. Gas after extraction is a better substitute for and can be mixed in larger proportion with natural gas. Its specific gravity is only .69 instead of .86. However, of special importance is the fact that aromatics, diolefins and part of olefins, a great obstacle to substitution, are removed by the extraction process. Conventional oil scrubbing generally removes at best only 50% of the aromatics. Even in relatively small concentrations, the aromatics create excessive luminosity in oil gas flames and cause carbon deposits in pilots.[16] The extraction process removes practically all of the aromatics (approximately 98%). The diolefins (butadiene, cyclopentadiene), over 95% removed by the extraction process, when present, are responsible for flashbacks on turndowns or turnoffs and for yellow tips on the appliance burners.[16] Conventional scrubbing does not remove these unsaturates.

2. The extraction process removes the organic sulphur (as much as 30 grains per 100 cu.ft. in form of thiophene, carbon disulphide, mercaptans, etc.) and leaves the oil gas after extraction sufficiently pure for reforming in the presence of a nickel catalyst. Without such purity, oil gas cannot be used for catalytic reforming because of the poisoning of the nickel catalyst. This is of special interest, as part of the oil gas after extraction may be used to produce reformed gas with high hydrogen content (up to 70%).[18] The gas after extraction is much cheaper than other reforming feeds. The removal of higher hydrocarbons from the oil gas will facilitate its reforming. The hydrogenation of oil gas permits 100% interchangeability with natural gas.[6, 17] It may be applied to cover high peakload in addition to the oil gas subjected to extraction, or for hydrogenation of oil gas for the extraction process. The hydrogenation makes possible the use of very heavy fuel oils, which otherwise cannot be handled in an oil gas generator. It also permits increasing the capacity of existing oil gas sets by as much as 30% depending on the fuel (after deduction of oil gas used for reforming).[17]

3. The gas after extraction is perfectly purified not only from sulphur but it is also free from condensibles, which when present tend to cause corrosion and difficulties in the distribution system, meters and appliances.

4. Since the gas after extraction is available at 60 lb. per sq. in. it may eliminate the need for compression, sometimes required for higher pressure distribution. The fuel consumption depends on the type of fuel used. The higher the Conradson carbon content, the greater is the consumption for gas making, the higher the tar yield, the more reduced the capacity but the lower the cost per gal. The composition of the oil gas is not much affected.

The following are operating data (Institute of Gas Technology, PB-18) for typical fuels for gas making, with and without hydrogenation.

a. Residue crude oil, 23.2° API, 5.4% Conradson carbon, and C:H 7.02 without hydrogenation of oil gas.

a-h Same as a, with hydrogenation of oil gas using 72.65 cu.ft. of hydrogen per gal. of fuel for gas making.

b. Very heavy fuel oil No. 6 with 13° API 12.9% Conradson carbon and C:H 8.32, without hydrogenation of oil gas.

b-h Same as b, with hydrogenation of oil gas using 52.4 cu.ft. of hydrogen per gal. of fuel for gas making.

Economical Advantages

In case of hydrogenation of oil gas, additional fuel will be required for the production of additional oil gas needed as reforming feed and for the heating of the oil gas generator. The additional fuel is 2.74 gal. per 1,000 cu.ft., bringing the total for a-h to 12.1 gal. per 1,000 cu.ft., and for b-h to 14.89 gal. per 1,000 cu.ft. The economical advantages depend to a great extent on the prevailing market prices of fuel and tar. Any variation in such prices are likely to be followed by variation in the prices of by-products. Thus, any such figures have to be adapted to the specific project.

This study is based on the use of heavy fuel oil of 8% to 10% Conradson carbon content. This is an average of the two extreme cases, as in the foregoing, *i.e.*, (a) 5.4% Conradson carbon and (b) 12.9% Conradson carbon. The consumption of such fuel for gas making, based on available operating data, was assumed at 12.5 gal. per 1,000 cu.ft. of gas of 1,000 B.Th.U., and for heating at 1.7 gal. per 1,000 cu.ft. A price of 7.35 cents a gal. (or approximately 50 cents per mill. B.Th.U.) for such fuel was assumed. If delivery to plant site by tankers is pos-

TABLE 4

Run	*a* 30	*a-h* 30-A	*b* B3	*b-h* 34-B
f) Fuel for gas making gal. per mill. B.Th.U.	10·55	7·85	13·42	10·87
f1) Fuel for heating oil as generator gal. per mill. B.Th.U.	1·93	1·51	1·62	1·28
f2) Total f + f1	12·48	9·36	15·04	12·15
f3) Tar yield in % of f)	43·5	33·1	55·2	53·3

sible, the price will be only 6.8 cents per gal. The tar price (dehydrated 98%) of 12 cents per gal. was based on offers received. In view of the long-term road building programme, tar is expected to meet with a receptive market for many years to come. To produce an oil gas of 1,250 B.Th.U. per cu.ft. 25% increase in above consumption for make gas (1,000 B.Th.U. per cu.ft.) was considered, as in case b. However, only a 15% increase in heating was considered for a 1,250 B.Th.U. per cu.ft. gas, as the cracking temperature is decreased to produce a higher calorific value oil gas. The 44% tar oil was similar to the lower value as per above, and approximately 20% below the yield for b.

As either gas after extraction of liquid fuel may be used to cover the heat requirements of the plant, including dehydration of tar, and since gas is considered to cover the power requirements of the extraction plant, such requirements are considered separately.

Heat and power requirements (R) for the following typical cases are:

During low load periods: A—Use only gas after extraction (E) to cover all heat requirements (R) including dehydration of tar and including power. During heavy load periods. B—Use only liquid fuel (heavy oil) to produce all heat required and use gas after extraction (E) for the power requirements of the extraction plant.

The heat and power requirements (R) per 1,000 cu.ft. of oil as of 1,250 B.Th.U. per cu.ft. are shown in Tables 5 and 6.

OPERATING COST FOR THE EXTRACTION AND FRACTIONATION PLANT (6 MILL. CU.FT. PER DAY), WITHOUT FUEL, FOR POWER AND HEAT, SOLUTION P_2.

		Cents per cu.ft. of oil gas
	Labour—three for day shift and two for each other shift (56 hours @ $2.20/hour)	2.05
	Manager-chemist—8 hours @ $6.00 an hour—$48.00/day	0.80
	Various, including maintenance, water chemicals, royalties, etc.	4.15
E	Total cost of extraction	7.00
	Total oil gas and extraction (without cost for fuel for heating) (OG+E)	53.35

Available gas after extraction; 1,000 cu.ft. of oil gas of 1,250 B.Th.U. per cu.ft., i.e., 1.25 mill. B.Th.U., corresponds to 873.2 cu.ft. of 975 B.Th.U. per cu.ft., *i.e.*, 854,000 B.Th.U. After deduction of the volume of gas used to cover heat and power requirements, the following quantities of gas (E) will be available:

The operating conditions for typical gas plant is illustrated below.

A gas plant has an average day sendout of 10 mill. cu.ft. per day, with a load factor of approximately 40%. The load

TABLE 5

		A B.Th.U. Gas	*B B.Th.U. Gas*	*B gal. fuel oil (150,000 B.Th.U. per gal.)*
OG	Oil gas generator			
	Heating of oil gas generator	292,000		1·95
	Dehydration of tar	100,000		0·67
	Steam in addition to production of steam in waste heat boiler of oil gas generator (appr. 50 lb. per 1,000 cu. ft. oil gas) additional steam approximately 20 lb. per 1,000 cu. ft. oil gas (airblower driven by steam turbine)	30,000		0·20
	Total oil gas generator	422,000		2·82
E_1	Extraction of by-products (other than tar) for solution P_2			
	Power (compression, refrigeration, etc.) gas engine driven 7 kWh per 1,000 cu ft. oil gas at 11,000 B.Th. U per kWh	77,000	77,000	
	Heat for extraction and fractionation of benzene	65,000		0·44
	Total for extraction	142,000	77,000	0·44
	Total R (O + E_1)	564,000	77,000	3·26

TABLE 6

COST OF FUEL FOR GAS MAKING PER 1,000 CU. FT. OF OIL GAS OF 1,250 B.TH.U. PER CU. FT. LESS CREDIT FOR TAR (FOR A 6 MILL. CU. FT. PER DAY PLANT)

		Per 1,000 cu. ft. gal.	*Unit price cents/gal.*	*Total cents per 1,000 cu. ft.*
E1)	Fuel for gas making	15·62	7·35	114·80
	Credit for tar	6·87	12·0	—82·44
	Cost of fuel less tar (without fuel for heating and dehydration of tar)			32·36
	Operating cost for the oil gas production (labour, maintenance, purification, water, electricity, etc., without steam for heating except recuperation from waste-heat boiler			14·0
OG	Total operating cost for oil gas production (without fuel requirements for heating)			46·36
	Operating cost for the extraction and fractionation plant (6 mill. cu. ft. per day) without fuel for power and heat, for solution P_2 above.			

Available for sendout in gas (E) in B.Th.U. per 1,000 cu. ft. of oil gas of 1,250 B.Th.U. per cu. ft.

A 854,000 B.Th.U. less 564,000 B.Th.U. .. .. 290,000 B. Th.U.

B 854,000 B.Th.U. less 77,000 B.Th.U. .. .. 777,000 B.Th.U.

The volume of gas after extraction (E) of 975 B.Th.U. per cu. ft. available for sendout and/or mixture with natural gas will be as follows per 1,000 cu. ft. of oil gas (1,250 B.Th.U. per cu. ft.) :

A 0·8732 less $\frac{564,000}{975 \times 1,000}$ or 0·58 remaining ·293 mill. cu. ft. and for a plant of 6 mill. cu. ft. per day .. .. 1·758 mill. cu. ft. per day

B 0·8732 less $\frac{77,000}{975 \times 1,000}$ and for a plant of 6,000 mill. cu ft. .. .. 4·75 mill. cu. ft. per day

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curve is based on 6,800 degree days (DD) and 65 DD for the coldest day. However, the maximum day load was increased from 21.2 mill. cu.ft. per day to 27.5 mill. cu.ft. per day in order to cover exceptionally cold days (higher than 65 DD). An oil gas and extraction plant for a capacity of 6 mill. cu.ft. per day operating at full rated capacity each day of the year is assumed. Not only the cost of manufactured gas will be substantially reduced as shown below, but the cost of natural gas will be lower as the load factor for natural gas will be increased from 40% to 60%.

Period L-1: During approximately 205 days a year (365 less 160), all requirements for heat and power (R) could be covered by gas (E) as in solution A. The volume of gas (E) as in solution A available will be 1.758 mill. cu.ft. per day, representing 17% to 40% of the sendout, the balance of the requirement being covered by natural gas.

Period L-2: For approximately 135 days (160-25), solution B may be applied. During this period liquid fuel is used for heat requirement, and gas only for power for extraction. The available gas (E) represents 4.75 mill. cu.ft. per day corresponding to 30 to 43% of the mixture with natural gas.

Period L-3: During approximately 25 days, as demand load goes up, oil gas is added to the mixture of 15.75 mill. cu.ft. per day representing, for instance, 11 mill. cu.ft. per day natural gas and 4.75 mill. cu.ft. per day gas (E).

As gas (E) is nearly interchangeable with natural gas for the highest peakloads day (27.5 mill. cu.ft.) the mixture of gas (E) and oil gas may represent as much as 60% of the total supply. The oil gas to be produced may represent in average approximately 3.5 mill. cu.ft. per day. Based on above conditions, the application of this process will have the results shown in Table 7.

For a 10 mill. cu.ft. per day average sendout, 2,439.5 mill. cu.ft. per year (3,650 mill. less 1,210 mill. cu.ft. per day) will have to be supplied in natural gas. If the contractual demand load is 11 mill. cu.ft. per day, then the load factor for natural gas supply is approximately 60% instead of 40%, as at present. Cost of gas after extraction per mill. B.Th.U. for case (b) and for by-products as per solution P_2 will be as follows considering the following operations:

R_1 Using liquid fuel for the heat requirements during all year at 3.26 gal. per 1,000 cu.ft. and gas for power for extraction, shown in Table 8.

R_2 Covering the heat requirements during low load periods with gas (E) (205 days per year) and for heavier load periods with fuel the average fuel will be 1.43 gal. per 1,000 cu.ft. (using gas for power requirements of the extraction plant). As shown in Table 9.

Heavy fuel oil at 7.35 cents a gal. represents a cost of 50 cents per mill. B.Th.U. (150,000 B.Th.U. per gal.). However, the difference in efficiency between heavy oil and gas for burning and also the cost of heating and handling heavy oil may result in an increase of over 8%, depending on usage.[18]

The comparative cost of heavy fuel oil will then be 54 cents per mill. B.Th.U. for a cost of 7.35 cents a gal. The present cost for natural gas in New England, based on a 60% load factor, is around 54 cents per mill. B.Th.U., and for a customary load factor of 40%, it is 66 cents per mill. B.Th.U. Compared with heavy fuel oil (used for power plants, etc.) or to natural gas at 54 cents per mill. B.Th.U., the savings, based on equivalent heat value will be for R_1 34.3 cents per mill. B.Th.U., and for R_2 47.48 per mill. B.Th.U. As for a plant capacity of 6 mill. cu.ft. per day, under continuous operation the output in gas (E) will be for R_1 1,750,000 mill. B.Th.U. per year, and the annual savings will be $600,000.

Such a plant can be amortised from the savings in less than three years. The new tax regulations for 'declining balance depreciation' will permit setting aside larger amounts for depreciation in the first years (first year 20%, second 16%,

TABLE 7

Period	*Days*	*Average 1,000 cu. ft. per day Gas (E)*	*1,000 cu. ft per day Oil Gas*	*Total 1,000 cu. ft. per day for period*	*Total mill B.Th.U.*
L–1	205	1758	—	362,000	352,000
L–2	135	4750	—	642,000	652,000
L–3	25	4750	—	119,000	116,000
			3500	87,500	87,500
Total	365			1,210,500	1,180,500

TABLE 8

	R_1 *cents per 1,000 cu. ft. of oil gas*	R_2 *cents per 1,000 cu. ft. of oil gas*
Cost of gas after extraction	53·35	53·35
Liquid fuel 3·26 gal. per 1,000 cu. ft. at 7·35 cent per gal.	23·96	
1·43 gal. per 1,000 cu. ft. at 7·35 cent per gal.		10·55
Total	77·31	63·90
Credit for by-products as per P_2	−62·01	−62·01
Net Cost cent per 1,000 cu. ft. of oil gas	15·30	1·89 cent
Available in gas (E) in Mill. B.Th.U. per 1,000 cu. ft. of oil gas		
R_1 777,000 Mill. B.Th.U.		
R_2 500,000 Mill. B.Th.U. (average)		
Cost of gas (E) per Mill. B.Th.U.	19·7 cent	3·78 cent

TABLE 9

Annual savings for a plant operating under R_2			
Expenses			
Cost of oil gas and extraction 2,190 mill. cu. ft. of oil gas	@	53·35 cent per 1,000 cu. ft.	$1,170,000
Fuel for heating (for B) 6 mill. cu. ft. per day x 160 days	@	23·96 cent per 1,000 cu. ft.	229,000
Cost of additional oil gas 87 mill cu. ft. (for L-3)	@	70·0 cent per 1,000 cu. ft.	61,250
Total Expenses			$1,460,250
Credit for By-products—2,190 mill. cu. ft. with	@	62·01 cent per 1,000 cu. ft.	1,350,800
Credit for Manufactured Gas at cost of natural gas for 60% load factor, 1,180,500 mill. B.Th.U. per year	@	54·0 cent mill B.Th.U.	637,200
Total Credits			$1,987,800
Annual Savings based on natural gas at 54 cent per mill B.Th.U.			$527,500
Additional Profit on natural gas for reduction in price for load factor at 60% at 54 cent per mill. B.Th.U. compared to 66 cent per mill. B.Th.U. for 40% load factor—2,439,500 x 1·05 = 2,560,000 mill. B.Th.U. per year		12·0 cent mill. B.Th.U.	307,000
			$834,550

third 12.5%, etc.), and the total capital investment may be recovered from depreciation and the interests will allow to reduce substantially the taxes until the plant is amortised.

By extracting higher value products from the oil gas, this process makes possible to produce a gas from heavy oil at a cost much lower than either heavy oil itself or natural gas. While the oil gas and extraction plant is operated at full rated capacity all year round, the volume of manufactured gas available for sendout may be varied substantially by using part of the gas during low load periods, to cover part of the heat requirements of the plant. Part of the oil gas after extraction can be used for hydrogen production in a catalytic generator since the organic sulphur tending to poison the nickel catalyst is eliminated. By hydrogenation of the oil gas, a 100% substitute for natural gas is obtainable.

The gas after extraction is more easily interchangeable with natural gas than oil gas, as the sp. gr. is lower and the aromatics and diolefins are eliminated. Thus a perfectly purified gas without condensibles and available at 60 lb. per sq. in. gauge pressure is obtained. Savings due to low-cost manufactured and lower-cost natural gas due to increased load factor, will make possible amortisation of the plant in a short time, possibly less than three years. Fuel cost for power plant can be reduced drastically. The application of this process not only solves important problems facing the gas industry but also permits low cost production of basic products, which are in increasing demand by the chemical industry.

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From a paper to the North of England Section, I.G.E., April 3, 1958.

Co-operation Between Client and Contractor

By T. H. RILEY

THE POWER-GAS CORPORATION LTD.

CO-OPERATION takes place all the time in many of the everyday affairs of business and in the ordinary transactions dealing with a project. From the early negotiation stage, through design and installation, co-operation is taken for granted and must exist if the work is to proceed satisfactorily.

For example, one party, possibly in the course of a contract, may start off by contributing an imaginative idea which goes further than the original obligation and is yet so sound and attractive that it receives the practical response of the other party. One way of describing it is a willingness to do just a little more than one is obliged to do. Successful co-operation in these matters lies in the skill and care exercised by both contractor and client in sifting out and choosing ideas which are sound technically and economically, so that the subsequent effort is considered not to have been wasted.

The idea can evolve from the contractor or the client, though usually the contractor works out the design and supplies the equipment and the client provides the site and raw materials and takes care of the residue; both sides help in commissioning the job and studying the idea.

The benefits of co-operation work in two ways; the client reaps his reward in improved efficiency and reduced working costs, thereafter the contractor hopes to improve his design and sell more plant; I shall refer later to the changing situation which is taking place in this regard.

Co-operation pre-supposes a healthy financial relationship between client and contractor and an appreciation on both sides that the effort involved will cost money and should earn a fair reward. Often the very nature of the specialised work can only be satisfactorily handled by the most expert and skilled teamwork and, paying a contractor for this service merely by the hour overlooks the fact that the skill and knowledge of a team of experts, who can speed the problem most quickly to a solution, have been acquired over several years' training, and this organisation has to be retained so that it is available when required.

One way in which the customer can help, even if at times a special effort is involved, is in the collection and recording of reliable operating data; we all know how difficult this can be, particularly in an industry which experiences such a wide load factor at different seasons of the year. When a plant is commissioned, it is usual for a demonstration test to be carried out, but, nevertheless, records of plant which is well maintained and efficiently operated provide invaluable information on which a contractor can base designs. Equally of importance to liaison by chemists on process matters, is co-operation between mechanical engineers about maintenance work, and in this respect there may be much to learn from the methods adopted by the oil industry.

To explain what I want to convey I cannot do better than describe some of the events in the history of the Company for which I work, because they are almost classical examples of co-operation between client and contractor. I would like you to note that I have not confined myself to examples concerned with the gas industry, and, here, I would like to emphasise that co-operation can—and should—mean working in a much wider field of application.

The Power-Gas Corporation has a long history and tradition stemming from Dr. Ludwig Mond. In 1887 he installed in his works at Winnington, Cheshire, without first building a pilot plant, a 200-ton per day producer plant on the system which later became well known as the 'Mond producer gas system.' He formed the Power-Gas Corporation in 1901 as an engineering office to exploit his patent by selling and building plants throughout the world. Today, as contractors, we cannot be so venturesome as he was, because, in his first move he was his own customer, whereas today we are contractors who have to exist on the margin of profit which we earn on individual contracts, consequently we cannot recover our expenditure from the profits earned from the sale of products from the plant over the succeeding years.

Today, I am speaking to the Institution of Gas Engineers, who represent the town gas industry and, I believe, I can say truthfully that today we give service to the gas industry and that our interests are bound closely one with the other.

In the early days, and for a long time, my Company pro-

duced the bulk of its electrical power requirements in its own works at Stockton by means of a gas engine driven by gas from a Mond gas producer. This installation gave scope for trying out ideas and, in fact, much of Professor Bone's work was carried out in our works at Stockton. In those days this plant made a link with the client, in that full scale trials of difficult or little-known fuels could be demonstrated and design data determined on which to base and submit estimates and tender; this condition persisted until as recently as 1951 and one of the last examples of this aspect of co-operation was the carrying out of trials on a 200-ton sample of low grade Portuguese lignite and also 100-tons of coal from Pakistan. Today, the number of small isolated gas producer units is very small. A similar trend is to be seen taking place in the town gas industry.

With the development of synthetic ammonia, the Mond gas producer with its by-product recovery was quickly rendered obsolete and to take its place my Company accepted the challenge and made a name for itself in the design and construction of water gas plant and specialised equipment, such as plant for conversion of carbon monoxide to hydrogen with steam over a catalyst, the absorption of CO_2 by water under pressure and its subsequent regeneration or recovery, the absorption of carbon monoxide under pressure with copper liquor to treat and produce gas suitable for the ammonia, petroleum and heavy chemical industries. In this work we constructed some of the largest orthodox blue water gas plants in the world, in which one of the outstanding features has been the dry base assembly, which also is to be found on several of the recent large carburetted water gas units we have built in this country and abroad for the town gas industry.

Co-operation

This leads me to describe an outstanding example of co-operation in which my Company took part. Some time in 1935 we received a cable from a company in British Columbia who operate one of the largest smelters in the world. They had been carrying out pilot work in their own laboratories on the reduction of sulphur dioxide to sulphur by the medium of coke and oxygen. Their laboratory work had been done on a 2 ft. 0 in. diameter brick-lined generator through which they passed sulphur dioxide and oxygen; they had studied the reactions. They wanted to know whether we would place our knowledge at their disposal in translating their laboratory work into a full-scale plant and we arranged straight away for our Chief Chemist to spend some time with them.

They came to us because they believe that the normal dry base design of water gas plant was the most likely piece of equipment which could be used; obviously, the water seal of a wet base assembly was not suitable when sulphur dioxide was to be dealt with. Several special features had to be incorporated to avoid leakage of SO_2 to atmosphere, for instance, the ash boxes had double doors so that the plant could run continuously and not have to go on standby when ash boxes were being emptied; for feeding the coke fuel we fitted a continuous charger which employed a large intermediate storage hopper, a shaker plate feed and revolving distributor. For this special duty all valves and mechanical moving parts were specially jacketed and steam heated to prevent sulphur cooling and condensing on the seats and moving parts which would prevent them from operating properly.

Our contribution, in this case, was to sell the first unit at cost and agree to earn profit only when the process was proved successful and the criterion for this was to be when the second unit was ordered. There was a good deal more equipment following the sulphur dioxide reducer which our clients designed and installed and on which the process was also dependant, so that the success of the venture was a joint affair. We eventually built three generators employing our 8 ft. 6 in. diameter mechanical dry base assemblies complete with jacket boiler. We had stated the output would be 25 tons per day of sulphur; in practice 27 tons were obtained.

Another interesting example concerned a plant we built in Korea in the early 1930's for the production of synthesis gases, particularly hydrogen, required to boost the capacity of a hydro-electric scheme where the surplus power for hydrogen production diminished in the dry winter season. A few years later the production of magnesium became of world wide interest and with the threat of the second world war great energy was expended in finding new processes to meet the expected demand. A process was developed in Austria, one stage of which called for the removal and recovery of carbon monoxide from the circulating gases. An early licensee of this process was the Japanese Company who had installed and were operating our plant in Korea; they converted the copper liquor carbon monoxide removal plant we had built for them to function as part of the process to produce the magnesium. A British organisation also obtained a licence for the Austrian magnesite process and inspected the plant in Korea as one of the working examples. Having found a Power-Gas carbon monoxide removal plant doing the job, they came to us and later placed an order with us for a similar type of plant.

Many of you in the gas industry will remember the substantial efforts during the war to produce hydrogen for balloon barrage and, in this, my Company and our competitors, both played a great part.

I have already mentioned how my Company became experts in the production of hydrogen. For synthesis processes the plants they built were usually of large capacity and the degree of purity was that normally required for ammonia synthesis, which calls for a gas containing three parts of hydrogen to one part of nitrogen, with very low limits of carbon monoxide and carbon dioxide. This was usually achieved in those days by the classic processes of water gas production followed by the water gas shift reaction, carbon dioxide removal by water washing under pressure and carbon monoxide removal by copper liquor at still higher pressure and since it was practically always uneconomic to produce a water gas with less than 5% or 6% nitrogen content this combination could not be considered when gas of high hydrogen purity was required.

Hydrogen for balloon barrage requirements has to be of higher concentration, of the order of 98-99%, which was normally produced by eletrolysis of water. This method is more costly. There had, however, been one or two installations of steam iron plant designed and built on the Continent and, in fact, there was a steam iron plant at Cardington of foreign manufacture which produced the hydrogen for the dirigible R.101.

Not long before the outbreak of the second world war the need for hydrogen on a very large scale for balloon barrages became apparent and, fortunately, we had with us an engineer with experience in this field and several plants were installed. The rapid improvement in efficiency achieved within a period of only 18 months, comparing the first unit with the last to be installed, was a noteworthy achievement of industrial research. Nearly all these plants were installed in gasworks making use of water gas plant already in existence. The installations comprised the addition of steam iron hydrogen plant and high pressure compression units and the gasworks' personnel advised by a small team of specialists under the present Chairman of the South Eastern Gas Board, together with our own trained operators made an admirable working team.

Reducing Agent

In the early stages, water gas was the orthodox and accepted source of reducing gases, but looking around for means to reduce cost we carried out—with the co-operation of one of the stations—experiments using producer gas; producer gas is cheaper to produce but it contains only 40% instead of 90% reducing gases. We found, so far as the steam iron process was concerned, that the efficiency in terms of the amount of reducing gases remained substantially the same, but by this time the demand for hydrogen for balloon barrages was diminishing and no practical use was made of this technique on the installations in this country. Shortly afterwards, however, in 1945, my Company secured an order to supply gas-making plant for a nitrogen fertiliser works in South India, in which wood was to be the fuel from which to produce ammonia. We secured this order because we already knew we could make producer gas from wood and, based on the experience we had gained, we were confident we could use this producer gas as the reducing agent in steam iron hydrogen sets and make our hydrogen for the ammonia synthesis in this way. It meant a bold step in design, because in England we had adopted a standard 6 ft. 0 in. diameter steam iron hydrogen generator and on the very much larger scale that was demanded in South India we had to build seven steam iron hydrogen generators 12 ft. diameter. The plant was a great success and is still at work.

Perhaps it is interesting to digress here, and point out we

obtained this order from an American organisation who had set out with the intention of making water gas from charcoal made from wood, only to find that they were more likely to lose their charcoal up the stack during the blow.

We were also successful in selling several other steam iron hydrogen installations abroad, especially in India, where the gas was used for hydrogenation of vegetable oils into edible oils, margarine, etc.

Wide Range of Feedstocks

The development of the Segas catalytic cyclic oil gasification process illustrates another way in which collaboration works. This English process was first conceived in the laboratories of the South Eastern Gas Board, who set out to make town gas from heavy oil and the paper by Messrs. H. Stanier and J. B. McKean to the Institution of Gas Engineers in 1950 describes the early work. My Company decided the process was attractive, though, at the same time appreciating the need for a considerable amount of development, not only to establish designs of commercial sized units to use heavy oil, but to study the process so that it might be used to treat a much wider range of feedstocks.

The first steps were taken with the co-operation of the South Eastern Gas Board and North Eastern Gas Board. Two units each of a nominal capacity of .8 mill. to 1 mill. cu.ft. per day were designed, one being built at Sydenham and the other at York and our technical department worked in close association with the gasworks' staffs in setting these plants to work and establishing the conditions of operation. The papers by Mr. Nicholls in 1956 and Mr. E. R. Ward in 1957 describe the work which has been done on these plants.

On the basis of the results obtained from these units, further and larger units have been designed and are being installed and put to work in this country and abroad. The first one to be commissioned abroad was installed by our German licensees at Hameln. It has shown itself capable of treating a wide range of feedstock and I would like to mention particularly a test which was carried out on brown coal tar obtained from low temperature treatment of brown coal obtained in Eastern Germany. The results were so satisfactory that in collaboration with our German licensees two further large units are being built in Rostock in Eastern Germany.

All these show how confidence is based on experience, and also emphasises how the contractor has to rely upon his client to grant facilities for gaining this experience.

There is also a parallel between the steam iron process which we were developing actively about 15 to 20 years ago and the Segas process, in that both are cyclic processes and, I feel sure, I can speak for our design staff by pointing out that the success achieved by scaling up the dimensions and capacity of hydrogen plants gave confidence when more recently we had to establish the scaling up of designs in the ratio of 1-4 on Segas plants.

From my previous remarks I do not wish to give you the impression that the client is the one who has to take all the chances. I would now like to describe another way of collaboration with the aim of giving confidence to the client.

I will take as an example a piece of equipment which scrubs dust from gases. The Pease Anthony scrubber was first developed in the U.S.A. and proved very successful on a limited number of applications in certain industries. It seemed to us sound in first principles and the determining factor when making a choice of plant was the cost of power, as so often in dust cleaning problems. The efficacy and power costs for new applications was always a problem to determine and so we decided to build a small portable unit. We hire this unit to potential customers who can arrange for it to be fitted to their particular problem. The results can be studied, the degree of cleanliness achieved can be determined, the power consumption calculated with some accuracy and the disposal of the effluent provided for. Sometimes the results are not as good as expected, in which case we are saved from having a dissatisfied customer; in several cases the results have been to everyone's satisfaction as the installed design obviously benefits from the opportunity to study the behaviour of the pilot plant.

In the past, the gas industry may have looked upon its problems as being to a great extent problems peculiar to itself; undoubtedly, it pioneered the methods of manufacturing and distributing gas, later carbonisation extended into the coal and steel industries and in some of the examples I have described I hope I have explained to you how a contractor who is concerned with many gasification problems can serve as a link, meeting the needs of the gas industry and also of the chemical and petroleum industries.

Before nationalisation, contractors often specialised only in one or two gas-making processes and had a wealth of specialised experience to place at the disposal of individual gasworks; taking into account the wide range of local conditions which had to be met and the limited resources frequently made available to them by the individual works, they were, nevertheless, generally able to give good service. Naturally, the larger works and installations took a lead in tightening up efficiencies and improvements, but equally the contractors introduced fresh ideas and in nearly all cases had gained the confidence of the user to an extent that detail improvements from time to time were always being made.

For the future, I believe the gas industry will have to look more to high pressure gasification and this immediately introduces many techniques which have already been established by contractors and manufacturers who have already gained experience in such work for the heavy chemical industry.

High pressure gasification implies large central stations and, therefore, a limited number of installations with fewer opportunities for contractors to commission plants and unless the advantages of co-operation between client and contractor continue to be evident there is a danger if the contractor is not encouraged to maintain a sufficiently qualified and experienced staff to commission plant or for giving advice on operation, that the relationship between the two may undergo a subtle change.

Ideas conceived in research, whether by the Gas Council, one of the gas boards, or other national research institution, such as Department of Industrial and Scientific Research and the British Coal Utilisation Research Association, and the contractor themselves, have to be translated into practice and taking into account the scale on which industry today launches its expansion programmes calls for an ever increasing appreciation of the need to see that each party can continue to make its proper contribution. Recent announcements have proclaimed the schemes which are to be launched and a moment's reflection will call to mind the responsibility which contractors are called upon to bear when development of this kind is involved. My Company has been, and continues to be, actively connected with a number of such projects.

I have shown how the experience my Company gained in one part of the world has often been of benefit to work we are doing in other parts and, in my opinion, there is a challenge to the nationalised gas industry to see that the experience which is going to be gained on the momentous developments which are about to take place in the U.K. gas industry are made available so that we contractors can continue to be in a position to undertake major contracts abroad for the manufacture of gas.

Lead in Techniques

We who live in this island, have to admit that we must export in order to live, and in matters connected with engineering exports we can only do so successfully if, as a country, we lead in techniques. Great Britain has always pioneered the expansion of the town gas industry abroad, frequently in the early days by financing the formation of companies and also by building gasworks' equipment in all parts of the world. With the recent accent on the use of oil there has naturally been a tendency—possibly only short term—to look for processes abroad, usually the U.S.A. where oil is at present their main fuel. We must, perhaps, accept this situation temporarily and make the best use of it, though the Segas process is a notable exception to this trend. The work of Dr. Dent at the Gas Council Research Station is encouraging and it would be good to re-establish the predominance of Great Britain in methods of gas manufacture and, with co-operation between client and contractor there is no reason why we should not succeed.

I will now summarise the foregoing. For the purpose of this paper and to stimulate discussion, I have defined co-operation in the direction of development as a willingness between two parties, such as client and contractor, to do just a little more than one is obliged to do. It calls for sound choice of ideas; it presupposes a healthy financial relationship

between the two parties. The contractor can usually contribute by bringing ideas and experience from a wide field of knowledge gained abroad and from other though similar processes such as those applied to the heavy chemical and petroleum industries; the client can provide the site and facilities and be responsible for the collection of reliable data.

After describing a few examples, I discuss some of the possible effects arising from nationalisation and the move towards larger and centralised gasworks; I have drawn attention to the prestige which the U.K. gas industry has always enjoyed throughout the world and the important contribution this can make to exports which are of such vital interest to us all. It is up to all of us today to maintain this position and, bearing in mind the encouraging research work now being carried out in this country and stressing the importance of continued co-operation between client and contractor, I believe we shall succeed.

DISCUSSION

Mr. White, Chairman of the North of England Section, thanked Mr. Riley for his paper and noted particularly that co-operation between contractor and client was not a one-way street and that the gas industry should wherever possible feedback data to the contractor. The discussion was then open to the meeting and **Mr. W. R. Garrett,** Chief Engineer, Northern Gas Board, said it was a pity Mr. Riley had not gone further back into history where he would have found that the client designed plant and the contractor built it thereby building up his know-how and eventually became a specialised gas contractor. Would Mr. Riley give his views on the decline of the consulting engineer and whether by such a decline we have gained or lost. As far as the contractor and new plant was concerned, why, he asked, did things go wrong; he thought it was that contractors survived by making profits and the client would have a closer knowledge of the contractor's job if he had a spell in contracting, it could also happen that the contractor's man on site was over zealous to make a profit and thereby his company might fall down.

Mr. W. Sutcliffe, Divisional General Manager, Tyneside Division, was interested in Mr. Riley's limited definition of co-operation. He agreed with co-operation on the site but following the commissioning of the plant he wondered why the contractors did not supply data sheets so that the gas industry could give information which was of interest to the contractor more readily. **Mr. Riley** replied that it was a thing well worth looking into but which he was not in a position to answer on the spot.

Mr. Haddon, Stockton-on-Tees, asked whether Mr. Riley could make any comment on fixed price tendering. Mr. Riley said that in the last ten years this would not have been possible except on small jobs when the end was in sight before the job was begun; the fluctuating prices of labour and materials since the war had made such tendering impossible.

Mr. K. Francombe, Whessoe Ltd., mentioned the rise and fall clause and he said that nowadays it was advisable for the client to remember that there was a 'fall' clause. Up to now the position had always been one-sided and the contractor had been forced to put on price towards the end of the job owing to increases, but now perhaps the situation might be altered with the fall in the price of steel. He considered the consultant had gone out of existence in the gas industry owing to the increased ability of client and contractor on the technical side. All contractors should pay attention to clients' ideas on improvements of plant as the client was the man who ultimately had to live with it; the contractor for his part should be prepared to consider alterations provided they would give sufficient improvement to offset any cost against standardisation and thus affect the price of the job. Another question he would like to ask was how many contractors should be asked for a price—enough to be compatible with a competitive cost.

Dr. Milner, The Power-Gas Corporation Ltd., said that he read the paper as implying that only good relations with the client were the rule; there was a seamy side and he thanked a former speaker for mentioning this point. He agreed with Mr. Francombe that consultants had gone and he thought for the same reason as had been mentioned.

Mr. Garrett, speaking for the industry, mentioned that in connection with the collecting of data all contractors should do their own. He thought that the degree of co-operation should go as far as the client giving it but the contractor seeking it. Regarding the issuing of tenders he would like nothing better than to issue enquiries to not more than three; but invariably there was trouble as others came asking to be allowed to quote.

Mr. Matthew, Consett, asked where the gas industry could take a leaf out of the oil industry's book as mentioned by Mr. Riley in his paper. Mr. Riley replied by citing the motor industry's advanced planning on maintenance.

Mr. G. H. Challis, Whessoe Ltd., thought that useful discussion could take place between the completion of the plant and the starting up; it was at this point that the question of maintenance was most urgent; plant standing idle could be subject to corrosion, etc., much more than when the plant was actually working. Mr. Riley agreed.

GAS ON THE CONTINENT

Load Recorder for Meters of Bellows Type

PREVIOUSLY known recorders for registering the load on bellows-type meters had the disadvantage of not indicating directly the volumetric quantity passing through the meter. The evaluation of the charts and the determination of the hourly load is a time-consuming process. In order to achieve successful operational control it is necessary to have a load recorder which gives a continuous indication of the quantity and thus permits the reading of gas throughput.

Main requirements are the determination of maximum demand per hour of a meter for customers with maximum demand tariff, the determination of whether the correct size of meter has been installed, and the recording of gas supplied in measuring and control stations over constant intervals of time, as well as the supervision of various programmed controls. A description follows of some recorders which meet these requirements.

The electric average recorder is a meter of the normal indicating and recording type for measuring mean values of any kind. By means of this, one can determine the quantity flowing in a given time. The recorder gives a graphical integration of the load, where the quantity flowing is given for an interval of two minutes. The disadvantages are that it requires an external source of power and it does not indicate the maximum rate of flow.

The load recorder of J. Braun & Co.: In this meter a slide with pen is driven by an eight-day clockwork motor through gearing from right to left across a chart of waxed paper. The pen draws a visible line on the paper, the length of which is a measure of the load. The clockwork interrupts the movement of the pen at two-minute intervals and it springs back to its original position. Thus, 30 lines are drawn per hour. Charts are arranged to suit various meter ranges. The 60-mm. wide chart is driven at 10 mm. per hour. It also has the disadvantage of not indicating a short peak value.

In the load recorder of Dehm & Zinkeisen, which operates on the rotation indicator system of Dr. Horn, an indicating, flame-proof magneto is connected on the front side of the meter, directly below the indicator. It is fitted with a permanent magnet. The variable voltage produced is proportional to the speed of rotation and is transmitted along a pair of wires to an indicating recorder with a rotating coil mechanism. This method requires no external source of current. For the magneto to run at the minimum speed of approximately 150 r.p.m. a step-up gear must be inserted between it and the meter. The recorder, which can be up to 10 km. from the meter and connected by a normal pair of wires, is driven by a seven-day clock and uses a 100 mm.-wide chart moving at 20 mm. per hour. The record is a continuous line from an ink-filled pen and the volume of gas passed is the area of the chart obtained by planimetry. The accuracy of the instrument is $\pm$ 1% at 50°C.

Willi Schnörr. Das Gas-und Wasserfach. Vol 99, No. 5, January 31, 1958, p. 117, 2 pp., 2 ff.

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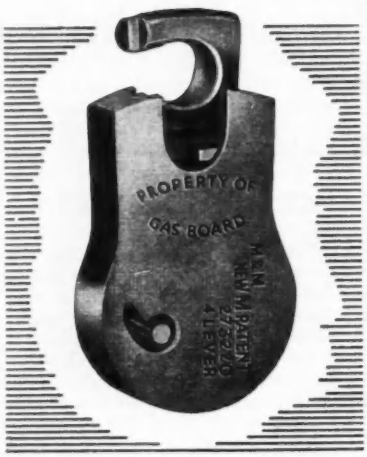

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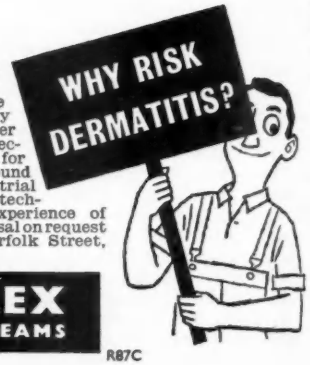

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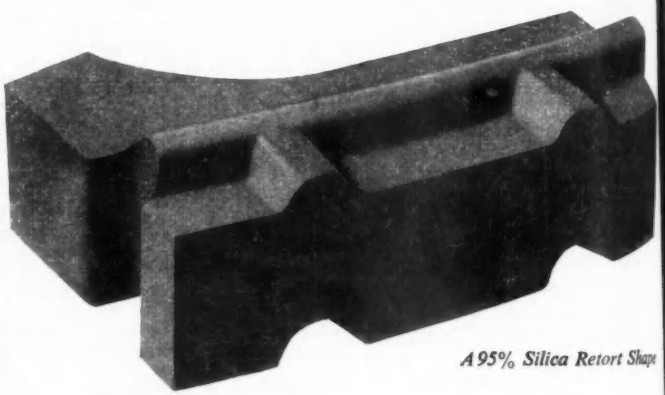

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